



A revision of the Pacific species of *Conocephalus* Thunberg (Orthoptera: Tettigoniidae)

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Synopsis

The species of *Conocephalus* Thunberg occurring on the Pacific islands are revised and three new species are described. Keys are given to the eighteen species recognized, and to their subspecies and forms. Eleven specific and subspecific synonyms are newly established, and a new name is proposed for a junior homonym. Accounts are given of the economic importance and biogeography. The songs of two of the species are described for the first time.

Introduction

I undertook this study as the result of an enquiry about the identity of *Conocephalus* species that had been found to be potentially useful in the biological control of a rice pest in Papua New Guinea (see p. 316). It soon became apparent that the specimens sent from Papua New Guinea could not be reliably identified until all the species of the genus occurring in the South Pacific had been revised. The geographical area covered by the study comprises the Pacific islands east of the Philippines and the Moluccas, extending northwards to the Tropic of Cancer and eastwards to the Marquesas Is. The countries and regions in this area from which I have examined material are listed in Table 1 (p. 318). Australia has a large number of endemic species, which I have excluded as being beyond the scope of the present study. I have examined 2150 Pacific specimens and many specimens from outside the Pacific area.

The genus *Conocephalus* was erected by Thunberg (1815) for 24 species; one of these, *Gryllus Tettigonia conocephalus* L., is regarded as the type-species by tautonymy. Many of the other species are now placed in the Copiphorinae. *Conocephalus* at present comprises approximately 100 valid named species in addition to the eighteen dealt with in the present study.

The prevalence of brachypterous and macropterous forms of the same species in *Conocephalus* has been misinterpreted by many earlier authors, who often regarded them as separate species. This source of confusion is evident in Redtenbacher's (1891) and Karny's (1907) revisions of the genus. Since 1907 there has been no comprehensive revision of *Conocephalus*, although partial revisions

have covered the Neotropical (Rehn & Hebard, 1915a; 1915b) and Palaearctic (Harz, 1969) species, and new species have been described by various authors. Kaltenbach (1968) and Hudson (1972) have dealt with the species of New Caledonia and New Zealand, respectively, but these studies cover only a few of the species occurring in the Pacific; most of the remaining species have not been discussed in the literature since their original description.

There is one New Guinea species of *Conocephalus* which I have been unable to include in this study. This is *Xiphidion consul* Karny, 1911: 344 (type-locality: Sattelburg), the holotype of which is lost (pers. comm. from Dr A. Kaltenbach of the Naturhistorisches Museum, Vienna). Karny's description does not entirely agree with any of the specimens I have examined, and no further descriptive information on the species has been published by subsequent authors. I am therefore unable to determine the identity of *X. consul* Karny and consider it to be a nomen dubium.

Karny (1926: 181) records a specimen of *C. melaenus* (de Haan) from New Guinea. I consider this is likely to have been misidentified, and I have not included this species in the present study since its distribution is entirely extralimital to judge from the numerous specimens which I have examined.

A number of subgenera have been described for the species of *Conocephalus*. Some of these consist of only one or two species and some others are based on rather unreliable characters such as the presence or absence of certain hind tibial spurs. I have found this character to be useful at the specific level in the species I have studied, but even so it is subject to intraspecific variation. Two of the three new species described in this paper are intermediate between two subgenera on the basis of this character, and I have therefore decided not to assign any species to subgenera. (See also p. 320.)

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I also particularly wish to thank Dr D. R. Ragge for his most helpful advice and criticism in the course of this study; Dr M. H. Robinson for sending me live specimens, some of which were used for making tape recordings of the songs; Mr W. J. Reynolds for invaluable assistance in making the song recordings and preparing the oscillograms used in this study, and for testing the identification keys; and Mr G. Young for information on the biology of some *Conocephalus* species.

Economic importance

Two species of *Conocephalus*, subsequently identified by me as *C. redtenbacheri* (Bolivar) and *C. semivittatus vittatus* (Redtenbacher), have been found to be important predators of eggs and nymphs of a serious rice pest, *Leptocorisa oratorius* (F.) (Hemiptera: Alydidae), in Papua New Guinea. According to Sands (1977) these species do not appear to damage the developing rice grains or eat any part of the rice plant apart from feeding to some extent on the stamens (together with other grass flowers) and should therefore be considered distinctly beneficial. In New Guinea, *C. redtenbacheri* is by far the more common of the two, judging from the specimens I have examined. Both species have also been recorded as preying on eggs of other Hemipteran pests: *Riptortus annulicornis* Bois (Alydidae) and *Nezara viridula* L. (Pentatomidae) (pers. comm. from Dr G. Young of the Department of Primary Industry, Konedobu).

C. saltator (Saussure) has also been reported as a predator of pests, by Zimmerman (1948) and Swezey (1905, under the synonym *Xiphidium varipenne* Swezey). It has been found in abundance in the sugar cane fields of the Hawaiian Is., feeding largely on young and adult sugar cane leafhoppers, *Perkinsiella saccharicida* Kirkaldy; the sugar cane bud moth, *Decadarchis flavistriata* (Walsingham) (formerly in *Ereunetis*), and other caterpillars; the coccid *Dymisococcus brevipes* (Cockerell) (formerly in *Pseudococcus*); and dipterous larvae. Swezey states that there is very little evidence of this species eating cane, although it will eat pollen from the blossoms of *Canna*,

Lantana and other plants. *C. saltator* is also considered to be a valuable predator of pineapple mealy bugs, and of the caterpillars and pupae of various bud moths which are pests of pineapples (see Illingworth, 1929: 256).

Although *C. saltator* appears to be chiefly beneficial, it has been reported as causing some damage to rice in the West Indies (Grist & Lever, 1969: 293). In the Pacific, it has been known to do so only occasionally. It has also caused occasional damage to corn and pineapples; in the latter case the damage is caused by laying its eggs in the flowers of the young fruit (Zimmerman, 1948).

C. longipennis (de Haan) and an unidentified *Conocephalus* species were recorded as feeding on nymphs and probably eggs of the rice ear bug, *Leptocoris oratorius* (F.), in Sarawak by Rothschild (1970). He states, however, that in these particular species the beneficial effect is probably largely nullified by their habit of feeding on developing rice grains. In fact, *C. longipennis* has been recorded as a minor pest of rice in Sarawak and New Guinea by Grist & Lever (1969: 293), although I have not seen any specimens, or other record, of the species from New Guinea. It is common on rice in W. Java, where a specimen has been observed eating an unidentified insect (Kalshoven & van der Vecht, 1950: 137). This species also occurs on rice in Malaya (Yunus, 1967), the Philippines, India and Bangladesh (specimens examined). I have seen specimens of *C. oceanicus* (Le Guillou), also collected from rice in the Philippines.

Various *Conocephalus* species, not included in the present study, have been recorded as pests of rice by Grist & Lever (1969: 292–293). These are *C. cinereus* (Thunberg) in Surinam, *C. propinquus* (Redtenbacher) in Guyana and Surinam, and *C. fasciatus* (De Geer) in Texas, U.S.A. This last species is known to be insectivorous as well (Marshall, 1964). I have seen specimens of *C. conocephalus* (L.), collected from rice in West Africa, where it feeds on some plant material and probably also eats the immature stages of a rice pest, *Aleurocybotus ? indicus* David (Hemiptera: Aleyrodidae) (pers. comm. from Mr J. C. Deeming).

It would therefore appear that *Conocephalus* species are often both predacious and herbivorous. Where they occur on plants of economic importance, species which are predominantly predacious can be very beneficial, while predominantly herbivorous species may be pests.

Biogeography

The species of *Conocephalus* in the Pacific can be divided into two groups on the basis of two quite different male characters. In one group the species have cerci with one internal spine and a small structure slightly basad of this as shown in Figs 2–11, hereafter referred to as a tubercle. They also have a stridulatory file with the row of teeth differentiated into large, well-spaced teeth at one end and tiny dense teeth at the other end (Figs 45, 46). In the other group the species have one, or in one case two, internal spines on the cerci but no tubercle; the stridulatory file is shaped as in Fig. 47, with comparatively uniform density and size of teeth. I am including *C. upoluensis* (Karny) and *C. albescens* (Walker) in the first group on the basis of their stridulatory file shape, although the tubercle of the cerci of these two species is extremely small or sometimes absent. One species, *C. tridens* Hebard, is intermediate between the two groups in the stridulatory file structure and the cerci are unique in the genus in having three internal spines. This species is endemic in the Marquesas Is. and does not seem to be related to any of the other Pacific species.

The species of the first group are known only from the Pacific and nearby islands such as the Moluccas (with the exception of a record of *C. oceanicus* from Vietnam) but most of the species in the second group have distributions extending well outside the Pacific, in several cases in Asia, and in two species also in tropical Africa, although they show no evidence of southern Gondwanaland relationships. One of the species in the second group, *C. saltator*, is known to have been introduced to the Pacific, and I think it is likely that most of the species in this group originated outside the Pacific since they lack characters shared by the species known only from the Pacific.

The distribution patterns of the *Conocephalus* species in the Pacific (Table 1) suggest that their dispersal has been largely achieved by flight. Most of the species that are at least sometimes macropterous occur on two or more islands and some are widespread in the Pacific. One of these species, *C. angustivertex* sp. n., is recorded only from New Guinea, but *C. bispinatus* sp. n. also occurs outside the Pacific, and *C. tridens*, although restricted to the Marquesas, occurs on several

Table 1 The distribution of the species of *Conocephalus* in the Pacific

	<i>oceanicus</i>	<i>starmuehleri</i>	<i>redtenbacheri</i>	<i>infumatus</i>	<i>semivittatus</i>	<i>semivittatus</i>	<i>vittatus</i>	<i>tumidus</i>	<i>trivittatus</i>	<i>upoluensis</i>	<i>albescens</i>	<i>bilineatus</i>	<i>maculatus</i>	<i>lactus</i>	<i>angustivertex</i>	<i>saltator</i>	<i>longipennis</i>	<i>willensei</i>	<i>bispinatus</i>	<i>tridens</i>
Hawaiian Is.															+					
Marquesas Is.	+																		+	
Tubuai Is.	+																			
Society Is.	+							+												
Cook Is.	+							+							+					
Line Is.															+					
Tonga Is.	+							+												
American Samoa	+							+							+	+				
Western Samoa	+							+							+					
Fiji Is.	+							+												
Ellice Is.	+																			
Caroline Is.																			+	
New Zealand						+				+	+									
Kermadec Is.						+														
Norfolk I.									+											
Lord Howe I.						+				+										
Loyalty Is.									+											
New Caledonia	+	+								+										
New Hebrides	+					+				+										
Solomon Is.				+	+	+				+										
New Britain; New Ireland				+	+	+				+										
Admiralty Is.				+		+														
Southern Australia						+				+	+	+								
Northern Australia				+		+				+			+	+					+	
Papua New Guinea	+	+				+	+			+			+	+	+				+	+
Irian Jaya				+		+				+			+	+	+					

islands in this group. On the other hand, each of the three species known solely from brachypterous specimens, *C. starmuehlneri* Kaltenbach, *C. tumidus* sp. n. and *C. trivittatus* (Stål), is recorded from only one island. Some dispersal is still taking place, for example the spread of *C. saltator* to the Line Is., Samoa and the Cook Is., following its introduction to the Hawaiian Is. from America in c. 1890.

The distribution patterns of Pacific *Conocephalus* species do not support a rigid system of biogeographical division of the Pacific. They show only slight evidence for the two Melanesian arcs discussed by Ross (1956), Hennig (1966) and other authors. *C. upoluensis* has an outer Melanesian arc distribution pattern in that it occurs from New Guinea to the Solomon Is., the New Hebrides, Fiji and Samoa, but it also occurs in New Caledonia and elsewhere in the Pacific. *C. redtenbacheri* and *C. semivittatus vittatus* occur from New Guinea to the Solomon Is. and to the New Hebrides respectively, but do not extend further. None of the species have the inner Melanesian arc distribution linking New Guinea, New Caledonia and New Zealand.

However, the distributions of the *Conocephalus* species do support the existence of some points of partial discontinuity between certain islands or island groups. Lee (1975) and other authors consider there to be a distinction between the biota of the Solomon Is. and the New Hebrides. This is supported in the present study by *C. redtenbacheri* and *C. infumatus* (Redtenbacher) which reach the eastern limit of their distribution in the Solomon Is. (including the Santa Cruz Is.) and *C. oceanicus* which occurs in the New Hebrides but has not been found in the Solomon Is. The present study corroborates the biogeographical inclusion of the Santa Cruz Is. in the Solomon Is. *C. upoluensis* occurs in both the Solomon Is. and the New Hebrides; however, this species is very widespread in the Pacific. *C. semivittatus vittatus* also occurs in both these island groups, but although it occurs in most of the northern islands of the New Hebrides, it has not been found in Erromango or the other islands south of Efate. This tends to corroborate Lee's suggestion of a major disjunction between Efate and Erromango separating the northern and southern New Hebrides.

There is also some differentiation between the *Conocephalus* occurring in northern Australia (Northern Territory and Queensland) and southern Australia; all except the widespread *C. upoluensis* are restricted to one or other region of Australia. This shows agreement with Gressitt (1961) and Thorne (1963). All the *Conocephalus* species found in northern Australia also occur in New Guinea. The species in southern Australia, other than *C. upoluensis*, also occur in New Zealand.

New Caledonia has been noted as having a high degree of endemism by authors including van Balgooy (1971) and Thorne (1963). In the present study one species, *C. starmuehlneri* Kaltenbach, is endemic in New Caledonia and probably arose from the ancestry of its close relative *C. oceanicus*, whose distribution includes New Caledonia.

Material

The material examined in this study is deposited in the following institutions.

BMNH	British Museum (Natural History), London
DSIR, Auckland	Department of Scientific and Industrial Research, Auckland
NM, Basle	Naturhistorisches Museum, Basle
MNHU, Berlin	Museum für Naturkunde der Humboldt-Universität, Berlin
ANIC, Canberra	Australian National Insect Collection, Canberra
MHN, Geneva	Muséum d'Histoire Naturelle, Geneva
BPBM, Honolulu	Bernice P. Bishop Museum, Honolulu
HSDA, Honolulu	Hawaii State Department of Agriculture, Honolulu
DPI, Konedobu	Department of Primary Industry, Konedobu, Papua New Guinea
RNH, Leiden	Rijksmuseum van Natuurlijke Historie, Leiden
NM, Maastricht	Natuurhistorisch Museum, Maastricht
MNHN, Paris	Muséum National d'Histoire Naturelle, Paris
ANS, Philadelphia	Academy of Natural Sciences of Philadelphia
NR, Stockholm	Naturhistoriska Riksmuseet, Stockholm
NM, Vienna	Naturhistorisches Museum, Vienna

Methods

All the morphological data were taken from dried adult specimens. The measurements given for all the previously described species were taken from Pacific specimens only (see Table 1 for summary of provenances), although specimens from the complete ranges were examined, when available, for other characters. In most species all the available Pacific specimens were measured; in the rest the measurements were taken from samples of at least 20 specimens of each sex of every species, subspecies or form, selected to cover a wide range of localities. Primary types from outside the Pacific were measured, although not included in the samples. Any measurements of these types outside the range given for any character has been noted under the relevant species.

Vernier callipers were used for all the measurements except the width of the fastigium, the male cercal length and the length of the stridulatory area, which were measured using a microscope with a moving stage vernier micrometer. Forewing length was measured on the flexed left wing, from where the pronotum overlaps the veins *Sc* and *R* to the apex. Ovipositor length was measured from the apex of the subgenital plate to the apex of the ovipositor. The length of the stridulatory area was measured as indicated in Fig. 39; male cercal length was measured on the right cercus, viewed laterally. Fastigium width was measured at the apex of the fastigium of the vertex, viewed dorsally. All the measurements listed are given in millimetres and the number of specimens measured is given in parentheses.

Pyroxylin replicas were made in order to examine the stridulatory structures of the under surface of the left male forewing, following the method described by Ragge (1969:172). Although it has proved extremely useful in some recent taxonomic studies of Tettigoniidae, the stridulatory file was of no help in the present study in distinguishing closely related species; however, the presence or absence of spinules around the file was sometimes useful.

The drawings of stridulatory files and whole forewings were prepared by tracing the projected image from a microprojector and a photographic enlarger respectively. A camera lucida attachment to a microscope was used for all the other drawings.

In this study the term 'macropterous' refers to specimens in which the hind wings extend beyond the forewings (when both pairs of wings are flexed); 'brachypterous' refers to those in which the hindwings are shorter than the forewings. The wing-venation terminology was taken from Ragge (1955).

All the distribution records are based on material I have examined, to avoid the possibility of including incorrect records due to mistaken identity. For most of the species I have been able to examine large numbers of specimens and in these cases I have abbreviated the data listed under 'Material examined', omitting collectors' names and abbreviating the dates to the months only. Where the species has been previously recorded from the country or island group concerned, I have given only the name of the country (or its major subdivision) or island without further details. For new records of a species from a country or island group I have given the locality data in full, except for sometimes abbreviating repeated localities to their initial letters. The data of type-material is always given in full. The term 'Island' is omitted following individual island names listed after an island group except in cases where this omission might lead to confusion.

For material from outside the main area studied I have listed only the countries or islands, or sometimes only the zoogeographical region. The data of primary types from extralimital localities is, however, always given in full.

Studio recordings were made of the songs of two of the species included in this study, by Mr W. J. Reynolds, Dr D. R. Ragge and myself, using a Kudelski Nagra IVD tape recorder and Sennheiser MKH 405 microphone. The oscillograms shown in Figs 48 and 49 were made from these recordings using a Mingograf 34T.

CONOCEPHALUS Thunberg

Conocephalus Thunberg, 1815: 214. Type-species: *Gryllus Tettigonia conocephalus* L., by tautonymy.

Ten subgenera of *Conocephalus* are currently regarded as valid by at least some authors. Of these only the following three have had any of the species included in this study assigned to them. (See also remarks on p. 316.)

Subgenus **CONOCEPHALUS** Thunberg, 1815: 214.

Hebard (1933) states in his description of *C. iridens* that the species may be referable to this subgenus.

Subgenus **ANISOPTERA** Latreille, 1827: 409. Type-species: *Locusta dorsalis* Latreille, by subsequent designation (Kirby, 1906: 274).

Xiphidion Serville, 1831: 159. Type-species: *Locusta fusca* F., by subsequent designation (Kirby, 1906: 274). [Synonymized by Kirby, 1906: 274.]

Xiphidium Burmeister, [1838]: 707. [Unjustified emendation.]

Neoxiphidion Karny, 1912: 8. Type-species: *Locusta fasciata* De Geer, by subsequent designation (Rehn & Hebard, 1915a: 157). [Synonymized by Rehn & Hebard, 1915a: 170.]

Thecoxiphidion Karny, 1912: 12. Type-species: *Xiphidium strictum* Scudder, by subsequent designation (Rehn & Hebard, 1915a: 157). [Synonymized by Rehn & Hebard, 1915a: 170.]

Species included in the present study which have been assigned to the subgenus *Anisoptera* (or its junior synonyms) by previous authors: *C. oceanicus* (Le Guillou); *C. starmuehlneri* Kaltenbach; *C. semivittatus* (Walker); *C. bilineatus* (Erichson)¹; *C. maculatus* (Le Guillou); *C. laetus* (Redtenbacher); *C. saltator* (Saussure); *C. longipennis* (de Haan).

Subgenus **CHLOROXIPHIDION** Hebard, 1922: 242. Type-species: *Xiphidium javanicum* Redtenbacher, by original designation.

Only one of the species included in the present study has been assigned to this subgenus by previous authors: *C. upoluensis* (Karny).

GENERIC DIAGNOSIS. ♂ ♀. Small to medium-sized Conocephalinae. Pronotum not produced backwards to cover stridulatory file. Prosternum unarmed or bispinose. Macropterous or brachypterous. Stridulatory area of left male forewing comparatively small. Fore and mid tibiae with 4–12 external (and similar number of internal) ventral spurs (usually 6). Mid femora usually unarmed, but occasionally (*C. bispinatus*) with extenroventral spines. Hind femora unarmed or with extenroventral (and occasionally also internoventral) spines. Male tenth abdominal tergite usually with two median projections at apex; otherwise truncate. Male cerci with 1–3 internal spines (one species, *C. bituberculatum* (Redtenbacher), is described as having no internal cercal spines). Male subgenital plate with wide, usually shallow, V-shaped incision, or truncate. Ovipositor straight or occasionally curved, of variable length.

DISCUSSION. Apart from *Conocephalus*, only two Conocephaline genera occur in the Pacific: *Fatuhivella* and *Nukuhivella*, both originally described by Hebard (1933) from the Marquesas Is., where they are endemic. These two genera, unlike *Conocephalus*, have the pronotum produced backwards in both sexes, so that in the male it covers the stridulatory organ; the males also have exceptionally specialized cerci.

One of the most striking features of the genus is the variation in wing length. Of the 18 species in the present study, nine are apparently always macropterous, three are known only from brachypterous specimens, and the rest have both forms. Of the species in the last category, some are strictly dimorphic without intermediates, notably *C. angustivertex*, while others show an almost continuous range of wing length, as in *C. redtenbacheri* and *C. saltator*. In *Conocephalus* variation in wing length within a species is in many cases correlated with variation in the size of the stridulatory area and the size of the cells formed by the forewing venation.

The genus is moderately uniform in general appearance apart from the wing length, but there are often clear differences between the species. Most of the Pacific species are easily distinguished from all the others, but there are a few species which form close-knit groups on the basis of morphological similarity. Two such species are *C. upoluensis* and *C. albescens*. A more complex group consists of *C. oceanicus*, *C. starmuehlneri*, *C. redtenbacheri* and *C. infumatus* (see under the discussions of these species). The taxa in this group, including the two forms of one of the species, show quite a strong tendency to be allopatric (see Fig. 1 and Table 1) and could possibly all be regarded as semispecies. The subspecies and forms of *C. semivittatus* (Walker) could also be semispecies.

DISTRIBUTION (Table 1). *Conocephalus* has a worldwide distribution between approximately 60°N and 45°S.

¹ Placed here by Karny (1912:11) but would now be assigned to *Chloroxiphidion* Hebard.

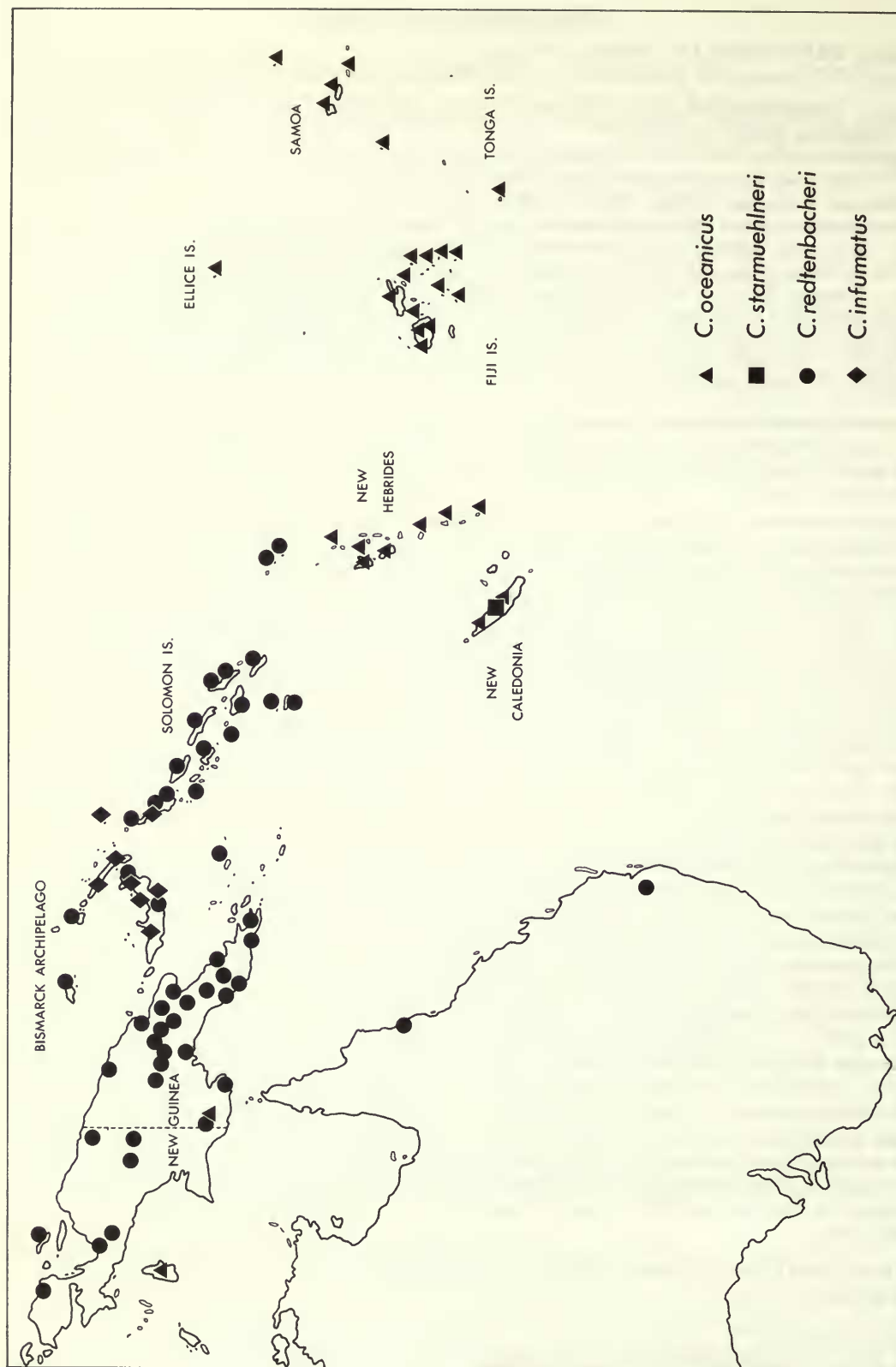


Fig. 1 Map showing the distribution of four species of *Conocephalus* in an area of the Pacific (sinusoidal projection).

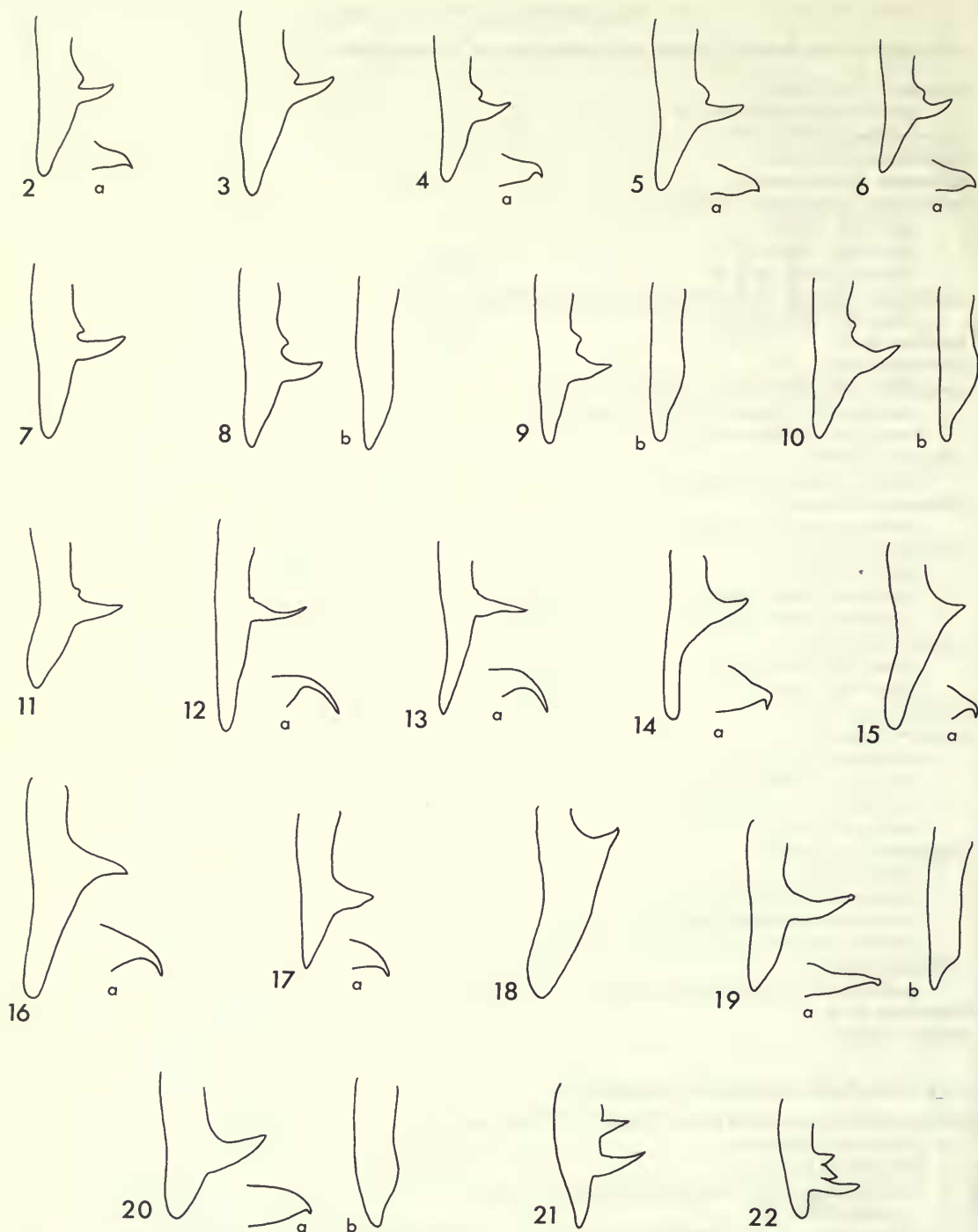
Checklist of the Pacific species and subspecies of *Conocephalus*

- oceanicus* (Le Guillou)
affine Redtenbacher **syn. n.**
starmuehlneri Kaltenbach
redtenbacheri (Bolivar)
infumatus (Redtenbacher)
semivittatus semivittatus (Walker)
maoricum Walker
antipodum Scudder
brunneri Karny **syn. n.**
semivittatus vittatus (Redtenbacher) **nom. rev., stat. n.**
geniculare Redtenbacher
tumidus **sp. n.**
trivittatus (Stål)
upoluensis (Karny) **nom. rev., stat. n.**
modestum Redtenbacher (junior homonym)
brevixiphus Willemse **syn. n.**
albescens (Walker)
latifrons Redtenbacher **syn. n.**
bilineatus (Erichson)
immaculatum Karny **syn. n.**
maculatus (Le Guillou)
lepida de Haan
continuum Walker **syn. n.**
neglectum Bruner **syn. n.**
laetus (Redtenbacher)
dubius Willemse **syn. n.**
raggei Harz **syn. n.**
angustivertex **sp. n.**
saltator (Saussure)
meridionale Scudder
propinquum Redtenbacher
brachypterum Redtenbacher
varipenne Swezey
longipennis (de Haan)
spinipes Stål
longicorne Redtenbacher
carolinensis Willemse **syn. n.**
carolinensis f. *macroptera* Willemse **syn. n.**
willemsei **nom. n.**
ensiferus Willemse (junior homonym)
bispinatus **sp. n.**
tridens Hebard

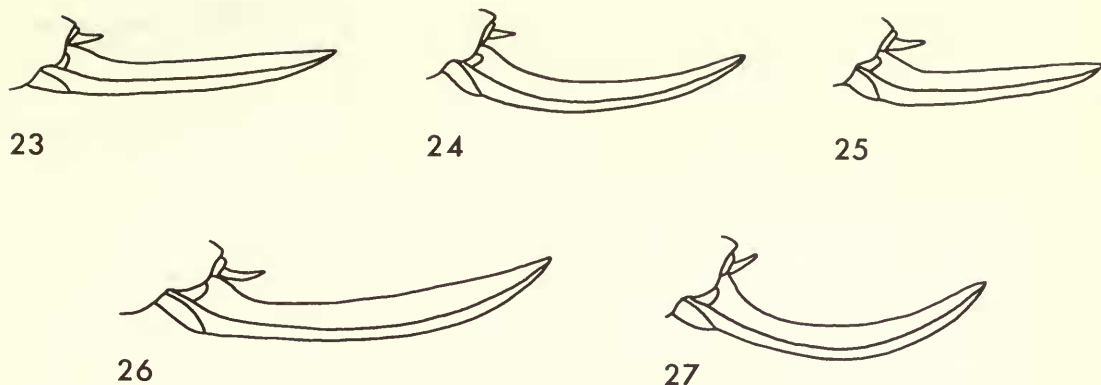
Key to the Pacific species of *Conocephalus*

Measurements given in this key are taken from Pacific specimens and may differ for extralimital material.

- | | | |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| 1 | Prosternum unarmed | 2 |
| — | Prosternum bispinose | 3 |
| 2 | Hind femora armed ventrally with spines. Male cerci with 2 internal spines (Fig. 21). Ovipositor straight (Fig. 25) | <i>C. bispinatus</i> sp. n. (p. 351) |
| — | Hind femora unarmed ventrally. Male cerci with 3 internal spines (Fig. 22). Ovipositor curved (Fig. 27) | <i>C. tridens</i> Hebard (p. 352) |
| 3 | Hind femora unarmed ventrally | 4 |
| — | Hind femora with externoventral spines | 12 |
| 4 | Forewings unicolorous. Ovipositor at least 13.7 mm long. Stridulatory area of left male forewing large (at least 2.7 mm long, measured as in Fig. 39) | <i>C. laetus</i> (Redtenbacher) (p. 345) |
| — | Forewings usually with some spots or other markings. If unicolorous, ovipositor not more than 13.2 mm long. Stridulatory area of left male forewing smaller (not more than 2.3 mm long) | 5 |



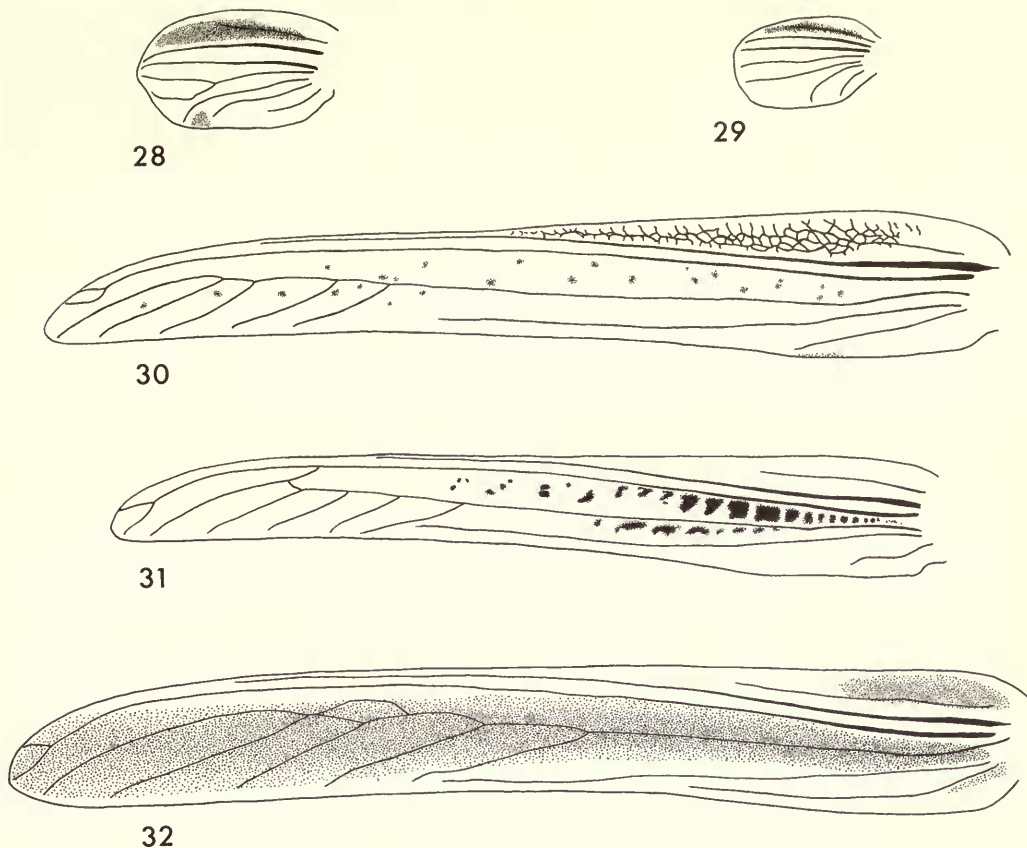
Figs 2–22 Dorsal view of the left male cercus, and in some cases (a) posterior view of the internal spine and (b) external view of the cercus of (2) *Conocephalus oceanicus*; (3) *C. starmuehlneri*; (4) *C. redtenbacheri*; (5) *C. infumatus* (typical form); (6) *C. infumatus* (small New Ireland form); (7) *C. semivittatus semivittatus*; (8) *C. semivittatus vittatus* (typical form); (9) *C. semivittatus vittatus* (small form); (10) *C. tumidus*; (11) *C. trivittatus*; (12) *C. upoluensis*; (13) *C. albescens*; (14) *C. bilineatus* (15) *C. maculatus*; (16) *C. laetus*; (17) *C. angustivertex*; (18) *C. saltator*; (19) *C. longipennis*; (20) *C. willemsei*; (21) *C. bispinatus*; (22) *C. tridens*.



Figs 23–27 Lateral view of the ovipositor of (23) *Conocephalus tumidus*; (24) *C. angustivertex*; (25) *C. bispinatus*; (26) *C. willemsei*; (27) *C. tridens*.

- 5 Forewings with large dark spots; no markings in the costal or precostal areas (Fig. 31)
 - *C. maculatus* (Le Guillou) (p. 344)
- 6 Forewings with dark pigmentation in the costal and precostal areas, with or without comparatively small spots on the rest of the wing (Figs 29, 30, 32); or unicolorous 6
- 6 Hind tibiae with 3 pairs of apical spurs (Fig. 40). Forewings unicolorous, or, if with dark markings, cross-veins of the costal and precostal forewing areas regular, parallel 7
- Hind tibiae usually with 2 pairs of apical spurs (ventral pair missing). If with 3 pairs of spurs: forewings with dark markings at least in the costal and precostal areas, although occasionally very faint; cross-veins of the costal and precostal forewing areas irregular, often reduced 8
- 7 Forewings unicolorous. Male cerci shaped as in Fig. 18, with one internal spine 8
- *C. saltator* (Saussure) (p. 347)
- Forewings with some darker pigmentation in the costal and precostal areas, as in Fig. 29, although sometimes faint. Male cerci shaped as in Fig. 11, with one internal spine and one tubercle *C. trivittatus* (Stål) (p. 340)
- 8 Brachypterous; forewing length not more than 6.1 mm 9
- Macropterous or brachypterous; forewing length at least 8.0 mm 10
- 9 Male cerci with one internal spine and one tubercle (Fig. 10). Ovipositor length not more than 8.5 mm *C. tumidus* sp. n. (p. 339)
- Male cerci with one internal spine (Fig. 14). Ovipositor length at least 10.5 mm *C. bilineatus* (Erichson) (p. 343)
- 10 Fastigium of the vertex relatively narrow (at most 0.57 mm). Forewings with dark pigmentation only in the costal and precostal areas, as in Fig. 29. Male cerci shaped as in Fig. 14 *C. bilineatus* (Erichson) (p. 343)
- Fastigium of the vertex relatively wide (at least 0.59 mm). Forewings with dark pigmentation in the costal and precostal areas, and usually with some small spots on the rest of the wing (Fig. 30). Male cerci shaped as in Figs 12, 13 11
- 11 Male cerci very slender in the apical part (Fig. 13). Male tenth abdominal tergite produced perpendicularly downwards (Fig. 42). Ovipositor length at least 11.8 mm *C. albescens* (Walker) (p. 342)
- Male cerci less slender in the apical part (Fig. 12). Male tenth abdominal tergite nearly unmodified, or slightly produced at apex but not bent downwards (Fig. 41). Ovipositor length not more than 11.0 mm *C. upoluensis* (Karny) (p. 341)
- 12 Males 13
- Females 23
- 13 Cerci with one internal spine (Figs 17–20) 14
- Cerci with one internal spine and one tubercle (Figs 2–10) 17
- 14 Forewings unicolorous. Hind tibiae with 6 apical spurs (Fig. 40) 15
- Forewings with dark pigmentation as in Fig. 32. Hind tibiae usually with 5 apical spurs (internodorsal spur missing; very rarely a small 6th spur is present) *C. angustivertex* sp. n. (p. 346)

- 15 Cerci shaped as in Fig. 18, with internal spine near base. Width of fastigium of the vertex at least 0.42 mm *C. saltator* (Saussure) (p. 347)
- Cerci shaped as in Figs 19, 20, with internal spine in the middle or towards the apex. Width of fastigium of the vertex not more than 0.37 mm 16
- 16 Internal cercal spine with a globular apex. Cerci comparatively slender, shaped as in Fig. 19 *C. longipennis* (de Haan) (p. 349)
- Internal cercal spine with a pointed apex. Cerci usually comparatively stout, shaped as in Fig. 20 *C. willemsei* nom. n. (p. 350)
- 17 Forewings with dark pigmentation in the costal and precostal areas (Figs 28, 29). Fastigium of the vertex comparatively wide (0.52–0.93 mm) 18
- Forewings without dark pigmentation in the costal or precostal areas. Fastigium of the vertex comparatively narrow (0.23–0.53 mm) 19
- 18 Cerci as in Figs 7–9; comparatively straight or only slightly bulging in profile. Hind tibiae with 6 apical spurs *C. semivittatus* (Walker) (p. 335)
- Cerci as in Figs 10, conspicuously bulging in profile. Hind tibiae usually with 4 apical spurs (ventral pair missing) *C. tumidus* sp. n. (p. 339)
- 19 Brachypterous 20
- Macropterous 21
- 20 *R* and *Sc* of forewings at most only very slightly darkened; very rarely darkened towards the base. Forewings comparatively wide, tapering comparatively abruptly towards the apex (Fig. 33). Length of cerci at least 1.8 mm; internal spine with a gradually curved apex as in Fig. 2a *C. starmuehlneri* Kaltenbach (p. 330)
- *R* and *Sc* of forewings usually darkened, at least towards the base. Forewings comparatively narrow, tapering gradually towards the apex (Fig. 34). Length of cerci not more than 1.7 mm; internal spine with a hook-shaped apex (Fig. 4a) *C. redtenbacheri* (Bolívar) (p. 331)
- 21 Forewings unicolorous. Internal cercal spine with a gradually curved apex (Fig. 2a). Width of fastigium of the vertex at least 0.4 mm *C. oceanicus* (Le Guillou) (p. 329)
- *R* and *Sc* of forewings usually darker than the rest of the wings, at least towards the base. If not, internal cercal spine with a hook-shaped apex (Fig. 4a), or width of fastigium of the vertex not more than 0.3 mm 22
- 22 Internal cercal spine with a gradually curved apex (Figs 5a, 6a). Stridulatory file usually with few surrounding spinules, as in Fig. 45 *C. infumatus* (Redtenbacher) (p. 333)
- Internal cercal spine with a hook-shaped apex (Fig. 4a). Stridulatory file surrounded by many spinules, as in Fig. 46 *C. redtenbacheri* (Bolívar) (p. 331)
- 23 Forewings with dark pigmentation at least in the costal and precostal areas as in Figs 28, 29, 32 24
- Forewings unicolorous or with dark pigmentation only outside the costal and precostal areas 26
- 24 Ovipositor gently curved (Fig. 24). Hind tibiae with 5 apical spurs (internodorsal spur missing; very rarely a small 6th spur is present). Width of fastigium of the vertex not more than 0.4 mm *C. angustivertex* sp. n. (p. 346)
- Ovipositor comparatively straight (Fig. 23). Hind tibiae with 3–6 apical spurs. Width of fastigium of the vertex at least 0.5 mm 25
- 25 Hind tibiae with 6 apical spurs. Width of fastigium of the vertex 0.52–0.83 mm. Subgenital plate with an excised or truncate apex; if truncate, width of fastigium of the vertex not more than 0.81 mm *C. semivittatus* (Walker) (p. 335)
- Hind tibiae usually with not more than 4 apical spurs (ventral pair missing or small). Width of fastigium of the vertex 0.83–0.91 mm. Subgenital plate with a truncate apex *C. tumidus* sp. n. (p. 339)
- 26 Forewing length at least 24.0 mm. Ovipositor comparatively broad as in Fig. 26 *C. willemsei* nom. n. (p. 350)
- Forewing length not more than 22.5 mm. Ovipositor comparatively narrow, not shaped as in Fig. 26 27
- 27 *R* and *Sc* of forewings usually darkened at least towards the base; if brachypterous, forewings comparatively narrow, tapering gradually towards the apex (Fig. 34) 28
- Forewings unicolorous or almost so; *R* and *Sc* at most only very slightly darkened, very rarely towards the base. If *R* and *Sc* slightly darkened; brachypterous, forewings comparatively wide, tapering comparatively abruptly towards the apex (Fig. 33) 29
- 28 Ratio of the pronotum length to the width of fastigium of the vertex at most 8.8 mm. Macropterous or brachypterous *C. redtenbacheri* (Bolívar) (p. 331)



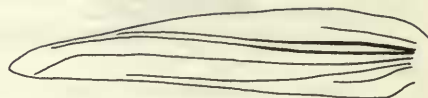
Figs 28–32 The left female forewing of (28) *Conocephalus semivittatus vittatus* (typical form) (brachypterous); (29) *C. tumidus*; (30) *C. upoluensis*; (31) *C. maculatus*; (32) *C. angustivertex* (macropterous). Macropterous and brachypterous specimens of the same species have a similar pigmentation.

- Ratio of the pronotum length to the width of fastigium of the vertex at least 9.0 mm.
Macropterous *C. infumatus* (Redtenbacher) (p. 333)
- 29 Brachypterous. Subgenital plate with a slightly excised apex (Fig. 43) *C. starmuehlneri* Kaltenbach (p. 330)
- Mostly macropterous. If brachypterous, subgenital plate with a truncate apex (Fig. 44) 30
- 30 Width of fastigium of the vertex not more than 0.42 mm. Ovipositor length at least 12.5 mm.
Subgenital plate with a widely excised apex *C. longipennis* (de Haan) (p. 349)
- Width of fastigium of the vertex more than 0.42 mm, or, if less than 0.42 mm, ovipositor length
not more than 11.5 mm. Subgenital plate with a truncate or shallow excised apex 31
- 31 *MA* of forewings shaped as in Fig. 35. Macropterous. Hind femora gradually swollen towards
the base (Fig. 37). Ovipositor length 8.3–11.1 mm. Subgenital plate with a shallow excised
apex *C. oceanicus* (Le Guillou) (p. 329)
- *MA* of forewings shaped as in Fig. 36 (macropterous). Macropterous or brachypterous. Hind
femora comparatively sharply swollen towards the base (Fig. 38). Ovipositor length
10.7–13.2 mm. Subgenital plate with a truncate apex (Fig. 44) *C. saltator* (Saussure) (p. 347)

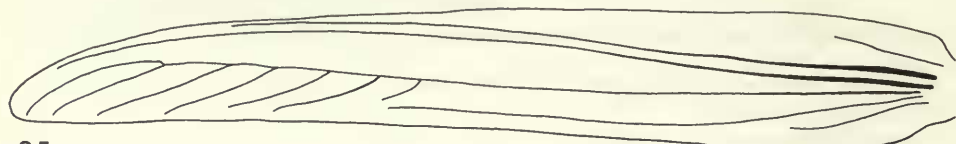
Positive identification of *C. oceanicus*, *C. starmuehlneri*, *C. redtenbacheri* and *C. infumatus* may prove to be very difficult in some cases owing to the variability of some of these species, and the subtlety of the distinctions between them. Specimens of these species can be identified in many cases by their geographical data (see under the descriptions of these species).



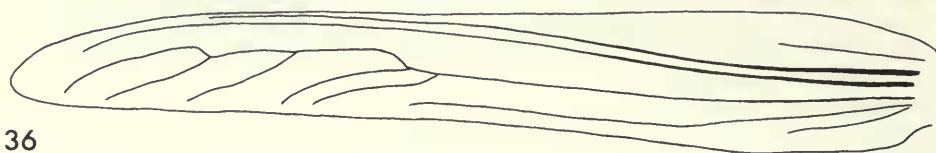
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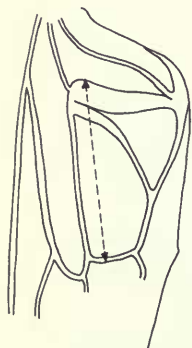
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Figs 33–44 33–36, the left female forewing of (33) *Conocephalus starmuehlneri*; (34) *C. redtenbacheri* (brachypterous); (35) *C. oceanicus*; (36) *C. saltator* (macropterous). 37, 38, the left hind femur of (37) *C. oceanicus*; (38) *C. saltator*. 39, dorsal view of the left stridulatory area of *C. laetus*, indicating the points between which measurements were made. 40, ventral view of the apex of the left hind tibiae of *C. saltator*. 41, 42, posterodorsal view of the male tenth tergite of (41) *C. upoluensis*; (42) *C. albescens*. 43, 44, ventral view of the female subgenital plate of (43) *C. starmuehlneri*; (44) *C. saltator*.

Descriptions of the Pacific species

Conocephalus oceanicus (Le Guillou)

(Figs 1, 2, 35, 37, 45)

Xiphidion oceanicum Le Guillou, 1841:294. LECTOTYPE ♂, SAMOA (MNHN, Paris), here designated [examined].*Xiphidion affine* Redtenbacher, 1891:513. LECTOTYPE ♂, FIJI IS. (NM, Vienna), here designated [examined]. **Syn. n.**

DIAGNOSIS. ♂ ♀. Fastigium of vertex moderately narrow. Prosternum bispinose. Macropterous. Forewings unicolorous. Cross-veins of costal and precostal areas of forewings mostly regular, parallel. *MA* of forewings shaped as in Fig. 35. Stridulatory file of left male forewing shaped as in Fig. 45, with few surrounding spinules (11 specimens examined). Hind femora not sharply swollen towards base (Fig. 37), with 1–7 extenroventral spines. Hind tibiae with 6 apical spurs. Male cerci as in Figs 2, 2a, with one well-developed internal spine with gently curved apex, and one tubercle. Female subgenital plate with shallow excision at apex. Ovipositor of medium length, relatively straight.

MEASUREMENTS

	Males	Females
Fastigium width	(23): 0.40– 0.53 (0.47)	(24): 0.42– 0.58 (0.50)
Median length of pronotum	(26): 2.4 – 3.2 (2.94)	(29): 2.5 – 3.6 (3.16)
Forewing length	(23): 11.5 –18.6 (15.68)	(27): 13.4 –20.7 (16.80)
Hind femur length	(20): 10.3 –13.9 (12.52)	(21): 11.1 –15.4 (13.54)
Cercus length	(22): 1.47– 1.81 (1.65)	
Ovipositor length		(28): 8.3 –11.1 (9.63)
Pronotum length/fastigium width	(22): 5.71– 7.62 (6.29)	(20): 5.52 – 7.27 (6.30)
Hind femur length/ovipositor length		(21): 1.29 – 1.52 (1.41)

DISCUSSION. *C. oceanicus* forms a very close group with *C. starmuehlneri*, *C. redtenbacheri* and *C. infumatus*, differing from the first in wing length, and the others in having unicolorous forewings; it also differs from *C. redtenbacheri* in the shape of the internal spine of the male cerci.

The similarity of *C. oceanicus* and *C. redtenbacheri* has led to them being confused in the literature. Redtenbacher's description of *Xiphidion affine* refers to specimens with unicolorous forewings or with the radial vein darker, which suggests that his syntype-series contained both species. I have examined 5 ♂, 2 ♀ from this series, all of which are *C. oceanicus*, and I have selected a lectotype from these specimens, thus fixing the identity of *X. affine* as a synonym of *C. oceanicus*. The other syntypes, which I have not seen, have the following data: Fiji: Ovalau. Samoa. Aru Is. (*Brunner*).

I have selected a lectotype of *Xiphidion oceanicum* from the type-series of 1 ♂, 3 ♀, all of which I have examined. Redtenbacher (1891:512) referred to *Xiphidion oceanicum* as a possible synonym of *Xiphidion longipenne* de Haan. I have examined the types of both species and found them to be distinct and very different species.

Further knowledge of *C. oceanicus*, *C. starmuehlneri*, *C. redtenbacheri* and *C. infumatus* may show them to be no more than forms of a single species. I am regarding them as separate species here as they have already been given specific status by previous workers, and there are distinct, although slight, differences between them. They cannot be considered as four subspecies of one species as the distribution of each overlaps with one or more of the others (see Fig. 1, Table 1, and the discussion on p. 321).

MATERIAL EXAMINED (175 Pacific specimens)

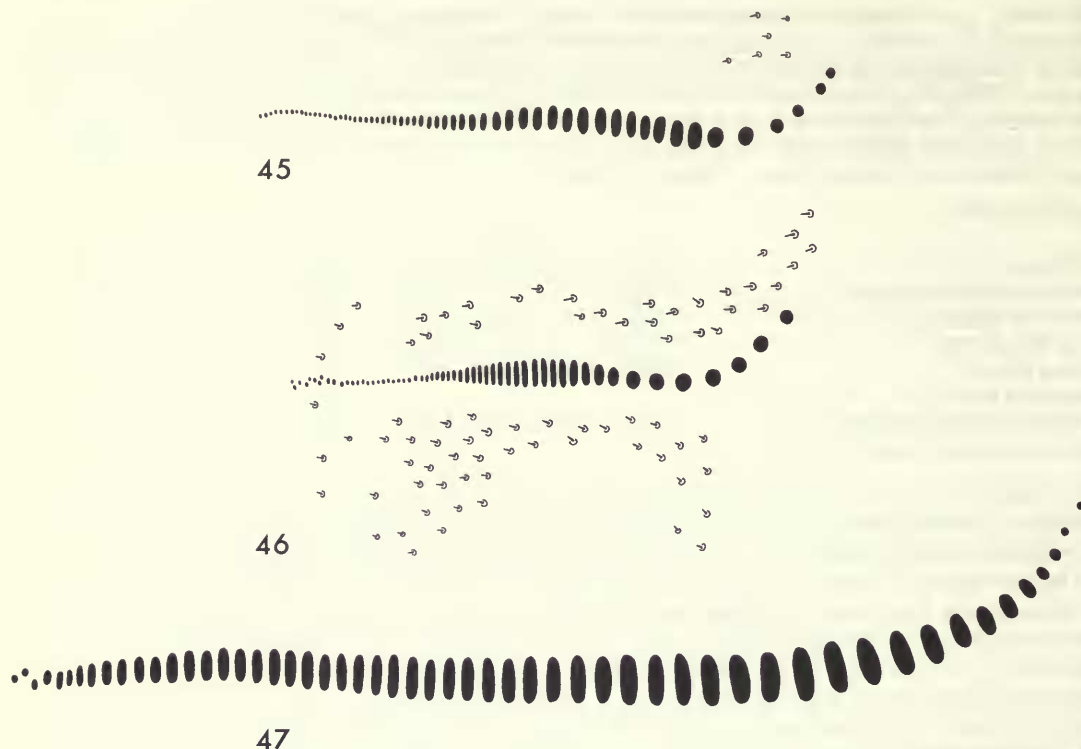
Xiphidion oceanicum Le Guillou, lectotype ♂, **Samoa** (*Jacquinet*) (MNHN, Paris). *Xiphidion affine* Redtenbacher, lectotype ♂, **Fiji Is.** ('Coll. Br. v. W. ex Mus. Godeffroy') (NM, Vienna).

Cook Is.: 1 ♂, Aitutaki, v; 1 ♀, Raratonga, vii. **Ellice Is.:** 3 ♂, 2 ♀, Funafuti I., Funafuti, 0–5 m, ii. **Fiji Is.:** 1 ♂ (*Thorey*) (NM, Vienna) (paralectotype of *Xiphidion affine* Redtenbacher); 2 ♀ (NM, Vienna) (paralectotypes of *Xiphidion affine* Redtenbacher); Avea; Fulanga; Komo; Lakemba; Matuku; Moala; Oneata; Ovalau; Taveuni; Vanua Levu; Viti Levu. **Marquesas Is.:** Nuku Hiva. **New Caledonia.** **New Hebrides:** Aneityum; Banks Is.; Efate; Erromango; Espiritu Santo; Malekula; Oba; Vanua Lava. **New Guinea:** Papua New Guinea. **Samoa:** 2 ♀ (*Jacquinet*) (MNHN, Paris) (paralectotypes of *Xiphidion oceanicum* Le Guillou); American, Swains; A., Tutuila; Western, Alafua; W., Savaii; W., Upolu. **Society Is.:**

Bora Bora; Huahine; N. Raiatea; Tahiti. **Tonga Is.:** 1 ♂, Niuatoputapu, v; 2 ♂, Tongatapu, vii; 1 ♂, 1 ♀, T., Nukualofa, ii-x. **Tubuai Is.** (Austral Is.): 1 ♂, Rurutu, iii. (BMNH; DSIR, Auckland; ANIC, Canberra; BPBM, Honolulu.)

Extralimital material. **Aru Is.:** 1 ♀ (MNHN, Paris) (paralectotype of *Xiphidion oceanicum* Le Guillou). **Philippines:** 3 ♂ (MHN, Geneva) (paralectotypes of *Xiphidium affine* Redtenbacher); Babuyan Is.; Luzon. **Vietnam.**

DISTRIBUTION (Fig. 1 and Table 1). This species is comparatively widely distributed in the Pacific.



Figs 45–47 Diagrams showing the arrangement of teeth in the stridulatory file on the under surface of the left male forewing, and the associated spinules of (45) *Conocephalus oceanicus*; (46) *C. redtenbacheri*; (47) *C. willemsei*. Other species, similar to these in the arrangement of the stridulatory teeth, may differ in the size of the file and in the presence or absence of surrounding spinules.

***Conocephalus starmuehlneri* Kaltenbach**
(Figs 1, 3, 33, 43)

Conocephalus (Xiphidion) starmuehlneri Kaltenbach, 1968: 548. Holotype ♂, NEW CALEDONIA (NM, Vienna) [examined].

DIAGNOSIS. ♂ ♀. Fastigium of vertex narrow. Prosternum bisipinose. Brachypterous. Forewings unicolorous, or at most veins *R* and *Sc* only slightly darkened (very rarely towards base). Forewings comparatively wide, tapering abruptly towards apex (Fig. 33). Cross-veins of costal and precostal areas of forewings regular, parallel. Stridulatory file of left male forewing shaped as in Fig. 45, with few surrounding spinules (5 specimens examined). Hind femora with 4–8 exteoventral spines. Hind tibiae with 6 apical spurs. Male cerci as in Fig. 3, with one well-developed internal spine with gently curved apex, similar to Fig. 2a, and one tubercle. Female subgenital plate with shallow excision at apex (Fig. 43). Ovipositor of medium length, relatively straight.

MEASUREMENTS

	Males	Females
Fastigium width	(8): 0.39–0.42 (0.41)	(11): 0.42–0.52 (0.46)
Median length of pronotum	(10): 2.9–3.2 (3.04)	(13): 3.1–3.7 (3.29)
Forewing length	(9): 7.8–10.7 (9.11)	(12): 6.9–8.3 (7.44)
Hind femur length	(6): 11.2–13.0 (11.92)	(13): 12.1–14.6 (12.90)
Cercus length	(8): 1.81–1.91 (1.84)	
Ovipositor length		(13): 10.1–12.2 (10.90)
Pronotum length/fastigium width	(8): 6.8–8.1 (7.53)	(11): 6.8–7.9 (7.29)
Hind femur length/ovipositor length		(13): 1.11–1.26 (1.19)

DISCUSSION. *C. starmuehlneri* closely resembles *C. oceanicus*, *C. redtenbacheri* and *C. infumatus*. It is distinguished from all except *C. redtenbacheri* by being brachypterous, and differs from brachypterous *C. redtenbacheri* in the shape of the male internal cercal spine, in the forewing shape, and in most cases in the fainter forewing pigmentation. *C. starmuehlneri* differs from *C. oceanicus* and *C. infumatus* in the ratio of the hind femur to ovipositor length, and in addition differs from *C. infumatus* in having fainter forewing pigmentation. If it were not for these differences *C. starmuehlneri* might be regarded as a brachypterous form of one of these species. I have seen a macropterous female specimen from New Caledonia: Bourail, which possibly belongs to this species. This specimen differs from both *C. oceanicus* and *C. infumatus* in having a ratio of hind femur to ovipositor length of 1.24, and has almost unicolorous forewings.

I have found a character used by Kaltenbach (1968) to separate *C. starmuehlneri* and *C. oceanicus* to be unreliable in the material I have examined; this is a longitudinal brown stripe on each side of the pronotum. These stripes are present in the type-specimens I have seen, although they are very faint in the holotype. They are not present, however, in the other material I have examined, which is otherwise identical with the type-material. Stripes on the sides of the pronotum, although not found in *C. oceanicus*, are present (usually faintly) in some specimens of another closely related species, *C. redtenbacheri*.

MATERIAL EXAMINED

Holotype ♂, **New Caledonia**: R. Negropo, near Canala, bank ['Uferregion'], 29.vii.1965 (*Österreichische Neukaledonien-Expedition*) (NM, Vienna).

New Caledonia: 7 ♂, 9 ♀ (BMNH); 1 ♂, col. d'Amieu, 650 m, (BPBM, Honolulu); 2 ♀, La Crouen, iii (BPBM, Honolulu); 1 ♂, upper course of R. Negropo, near Koh, 29.vii.1965 (*Österr. Neukaled.-Exped.*) (NM, Vienna) (paratype); 2 ♀, R. Negropo, near Canala, bank, 29.vii.1965 (*Österr. Neukaled.-Exped.*) (NM, Vienna) (paratypes).

DISTRIBUTION (Fig. 1 and Table 1). Known only from New Caledonia.

Conocephalus redtenbacheri (Bolivar)

(Figs 1, 4, 34, 46, 48, 49)

Xiphidium redtenbacheri Bolivar, 1905:389. Syntypes ♂, ♀, NEW GUINEA: Papua New Guinea, Sattelberg, 1898 (*Biró*) (lost). NEOTYPE ♂, NEW GUINEA (BMNH), here designated [examined].

DIAGNOSIS. ♂ ♀. Fastigium of vertex narrow. Prosternum bispinose. Brachypterous to macropterous. Forewings with veins *R* and *Sc* darkened, at least towards base, sometimes only faintly. Forewings (of brachypterous form) shaped as in Fig. 34. Cross-veins of costal and precostal areas of forewings regular, parallel. Stridulatory file of left male forewing shaped as in Fig. 46, surrounded by many spinules (14 specimens examined). Hind femora with 1–7 exteroventral spines; very rarely unarmed. Hind tibiae with 6 apical spurs. Male cerci as in Figs 4, 4a, with one well-developed spine with hook-shaped apex, and one tubercle. Female subgenital plate with shallow excision at apex. Ovipositor moderately short, relatively straight. Song as in oscillograms, Figs 48, 49, consisting of chirps lasting 1–3 seconds, repeated at a variable rate (usually c. 9 per minute), with a regular rate of c. 120 syllables per second. The songs of brachypterous and macropterous specimens were similar.

MEASUREMENTS

	Males	Females
Fastigium width	(35): 0.26–0.50 (0.36)	(27): 0.31–0.55 (0.43)
Median length of pronotum	(31): 2.2–3.1 (2.74)	(33): 2.4–3.5 (2.99)
Forewing length	(42): 6.6–17.6 (12.81)	(42): 5.5–20.6 (13.09)
Hind femur length	(30): 9.9–14.3 (12.10)	(23): 10.6–16.2 (13.65)
Cercus length	(36): 1.29–1.66 (1.48)	
Ovipositor length		(31): 6.8–10.7 (8.97)
Pronotum length/fastigium width	(31): 5.8–9.3 (7.71)	(26): 5.5–8.8 (7.09)
Hind femur length/ovipositor length		(22): 1.37–1.70 (1.51)

DISCUSSION. *C. redtenbacheri* closely resembles *C. oceanicus*, *C. starmuehlneri* and *C. infumatus*. It differs from all these species in the shape of the internal spine of the male cerci, and from the first two, in most cases, in the forewing pigmentation. Many spinules surround the stridulatory file of *C. redtenbacheri* whereas these are fewer and more restricted in the other three species (except occasionally in *C. infumatus*).

To judge from the material examined *C. redtenbacheri* is the commonest species of the genus in the Pacific. The large number of specimens examined showed considerable variation, particularly in forewing length, which ranged continuously from brachypterous to macropterous, although the intermediates were in the minority. Specimens from the Solomon Is. were always macropterous. Those from Solomon Is.: Ontong Java were usually particularly small, resembling the small New Ireland form of *C. infumatus*. The width of the fastigium of the vertex was also variable, particularly in New Guinea specimens, while some small populations elsewhere in the range were comparatively uniform.

The forewings were rarely as strongly pigmented around the veins *R* and *Sc* as those of *C. infumatus*, and were occasionally extremely faintly pigmented. It is therefore possible that some females of this species might not be distinguishable with certainty from females of *C. oceanicus* on morphology alone. Approximately 1% of the specimens examined lacked spines on one hind femur, and 1 ♂, 1 ♀ had no spines on either hind femur. I examined one specimen, which I believe to be an aberration of this species, with very tiny cerci; these differed in shape from those of the other adult males, although they were similar to those of nymphs of the species.

The syntypes of *Xiphidium redtenbacheri*, from New Guinea, were lost when the Orthopteroid collection of the Természettudományi Múzeum, Budapest, was burnt in 1956 (pers. comm. from Dr H. Steinmann). I have selected a male neotype, also from New Guinea, for which I have a song recording.

MATERIAL EXAMINED (1077 Pacific specimens)

Xiphidium redtenbacheri Bolívar, neotype ♂, **New Guinea**: Papua New Guinea, Morobe Province, Wau, c. 1200 m, Ecology Institute grounds, 3.vii.1979 (*Robinson*) (BMNH), associated with tape recording no. 301 (recorded by W. J. Reynolds and L. M. Pitkin; tape in BMNH Library of Recorded Insect Sounds).

Admiralty Is.: 1 ♂, Manus, 6 km SE. of Lorengau, Rossum, 180 m, xii. **Australia**: 1 ♀, Queensland, vi-vii; 1 ♀, Q., Aratula, xii; 2 ♂, Q., Cairns, iii-xi; 4 ♂, 1 ♀, Q., Cairns, Freshwater Creek, ii; 1 ♀, Q., Kuranda, 200 m, iii. **New Britain**: 1 ♂, Gazelle Pen., Keravat, 60 m, ix; 1 ♂, G. P., Keravat, ii; 1 ♂, G. P., Warongoi Val., 100 m, v; 2 ♂, 5 ♀, Nakanai Mts, Silanga, 150 m, vii-viii; 1 ♂, Vudal, vi. **New Guinea**: Irian Jaya; Papua New Guinea (and associated tape recordings). **New Hanover**: 1 ♂, v. **Solomon Is.**: 1 ♂, 1 ♀; 4 ♂, 6 ♀, Bellona, x-xi; 2 ♀, B., Henuangoto, v-x; 1 ♀, Biawa, iv; 2 ♂, 1 ♀, Bougainville, v-vii; 1 ♀, B., Buin, vi; 1 ♂, B., Buin (Kangu), 1–50 m, v; 2 ♀, B., Buin area, Konga Village, ii-iii; 1 ♂, 3 ♀, B., Buin area, Kugukai Village, 150 m, xi-i; 1 ♂, 1 ♀, B., Arigua, vi; 2 ♂, 1 ♀, B., Kieta, xi; 3 ♂, B., Kokure, 690 m, vi; 1 ♂, 3 ♀, B., Kokure, near Crown Prince Ra., 900 m, vi; 2 ♀, B., Mumurai, vi; 2 ♀, B., Mumurai, 400 m, vi; 1 ♀, B., Numa Numa, vi; 1 ♂, B., Sovele Mission, 250 m, vi; 2 ♂, 2 ♀, B., Teopasino, c. 5° 40' S, 155° 07' E, vi; 1 ♀, B., Tokinoitu, 20 m, vi; 1 ♂, Buka, Gagan, 40 m, vi; 1 ♀, Choiseul, Malangono, viii; 1 ♂, 2 ♀, C., Malangono, 10 m, iii; 3 ♂, 3 ♀, Guadalcanal, ii-xii; 3 ♂, 1 ♀, G., 900–1500 m, xii; 2 ♂, 1 ♀, G., Betikama R., viii-ix; 2 ♂, 2 ♀, G., Bonegi R., 210 m, xii; 1 ♀, G., Gold Ridge, iv; 2 ♂, 1 ♀, G., Gold Ridge, 500 m, vi; 1 ♀, G., Gold Ridge, 800 m, vi; 1 ♂, 1 ♀, G., Honiara, v-x; 2 ♂, 3 ♀, G., Honiara District, Tenaru, vii-x; 1 ♀, G., Tenaru, 0–100 m, i; 1 ♂, G., Tenaru R. (mouth), viii; 1 ♀, G., 30 km W. of Honiara, Tambalia, v; 1 ♂, G., 35 km W. of Honiara, Tambalia, 30 m, v; 1 ♂, 1 ♀, G., H. D., Poha R., vii; 2 ♂, G., Ilu Farm, near Nalimbu R., 5 m, vii; 3 ♂, 2 ♀, G., Ilu, ii-vi; 1 ♀, G., Kiwi Creek, viii; 3 ♂, 3 ♀, G., Kukum, i-vii; 2 ♂, 1 ♀, G., Lunga R. (mouth), v-vi; 1 ♂, 1 ♀, G., Metanikan R. (mouth), v; 12 ♂, 6 ♀, G., Nuhu, x; 1 ♀, G., Rua

Vatu, xi; 2 ♂, G., Suta, vi; 3 ♂, 3 ♀, G., Suta, 500–1200 m, vi; 1 ♀, G., Sutakiki R., vi; 1 ♀, G., Sutakiki R., 610 m, iv; 1 ♂, G., Tadhimboko, 0–100 m, x; 1 ♂, 1 ♀, G., Tapenanje, xii; 1 ♂, 3 ♀, G., near Terere, Roroni, 1 ♀, G., Tinahula R., iii; 1 ♀, G., Umasani R., 10 km inland, i–vii; 1 ♀, G., Wright's Creek, viii; 1 ♂, 2 ♀, Malaita, Auki, 2–20 m, ix–xii; 1 ♀, M., Kwailasi, Fulisango, v; 1 ♂, 1 ♀, M., Rai'ako, v; 1 ♂, 2 ♀, M., Sikiana, iii–x; 1 ♀, M., Su'u, iv; 1 ♀, Ndai, Bethlehem, 0–10 m, xii; 2 ♀, New Georgia Group, Gizo I., 30 m, vii; 1 ♂, N. G. G., G., 50–120 m, iv; 1 ♂, 1 ♀, N. G. G., G., Gizo 0–100 m, xi; 1 ♀, N. G. G., G., Loga I., x; 1 ♂, 1 ♀, N. G. G., Kolombangara, viii; 4 ♂, 2 ♀, N. G. G., K., Kuzi, x; 1 ♂, 1 ♀, N. G. G., K., Pepele, 30 m, ii; 2 ♀, N. G. G., New Georgia I., Munda, 1–30 m, vii; 2 ♀, N. G. G., N. G., Munda and district, viii; 1 ♂, 3 ♀, N. G. G., N. G., Segi, Maravo, v; 1 ♂, 2 ♀, Ontong Java, Kepae, i; 11 ♂, 9 ♀, O. J., Kiloma, i; 2 ♂, O. J., Leuanua, i; 5 ♂, 10 ♀, O. J., Peku, 0–10 m, xii; 6 ♂, 8 ♀, O. J., Pelau, ii; 3 ♂, 3 ♀, Rennell, Hutuna, x–xi; 2 ♀, Russell Is., Yandina, ix; 1 ♂, San Cristobal, Hawa, v; 3 ♂, S. C., Huni R. (mouth), viii; 1 ♂, S. C., Makina, v; 1 ♂, S. C., Waimamura, iv; 1 ♂, S. C., Wainoni, vii; 3 ♀, Santa Cruz Is., Utupua, xi; 6 ♂, 1 ♀, S. C., Vanikoro Is., ii–xi; 1 ♀, S. C., V., Buma, ix; 1 ♂, Santa Isabel, iii; 1 ♀, S. I., Allardyce Hbr, ii; 1 ♀, S. I., Gatere, ii; 1 ♀, S. I., Maringe Lagoon ('Lgu?'), ii; 1 ♀, S. I., Rasa, v; 1 ♀, S. I., Sisaga, ii; 2 ♀, S. I., Tatamba, ix; 1 ♂, Vella Lavella, Kow, 30 m, xi; 4 ♂, 6 ♀, V. L., Ulo Crater, 10 m, xii. (BMNH; ANIC, Canberra; BPBM, Honolulu; DPI, Konedobu.)

Extralimital material. **Philippines:** Mindanao; Palawan.

DISTRIBUTION (Fig. 1 and Table 1). This species is very common and widespread in the western Pacific.

Conocephalus infumatus (Redtenbacher)

(Figs 1, 5, 6)

Xiphidium infumatum Redtenbacher, 1891: 512. Holotype ♀, DUKE OF YORK GROUP: Mioko (between New Britain and New Ireland) (lost). NEOTYPE ♂, NEW BRITAIN (BPBM, Honolulu), here designated [examined].

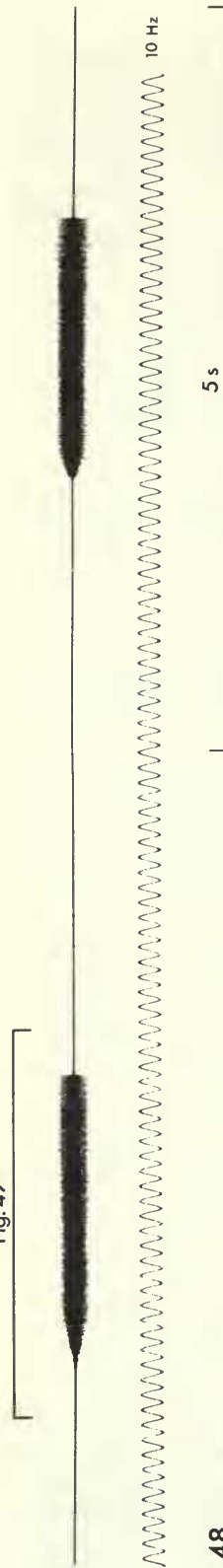
DIAGNOSIS. ♂ ♀. Fastigium of vertex narrow. Prosternum bispinose. Macropterous. Forewings with veins *R* and *Sc* darkened. Cross-veins of costal and precostal areas of forewings regular, parallel. Stridulatory file of left male forewing shaped as in Fig. 45, mostly with few surrounding spinules. Hind femora with 2–9 exteroventral spines. Hind tibiae with 6 apical spurs. Male cerci as in Figs 5, 5a, 6, 6a, with one well-developed internal spine with moderately gradually curved apex, and one tubercle. Female subgenital plate with moderately shallow excised apex. Ovipositor moderately short to medium length, relatively straight.

MEASUREMENTS

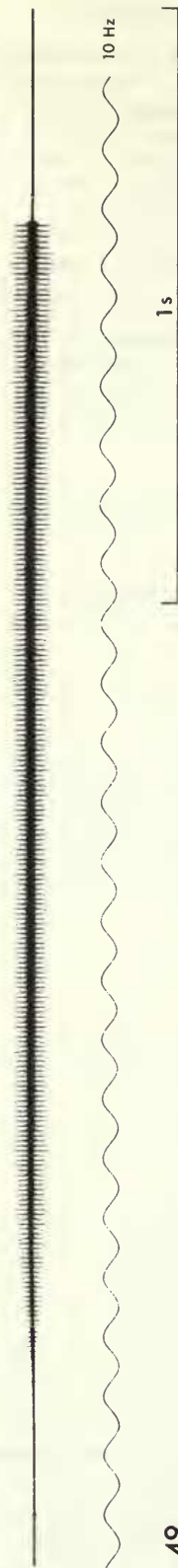
Typical form	Males	Females
Fastigium width	(10): 0.31–0.39 (0.35)	(33): 0.26–0.42 (0.34)
Median length of pronotum	(10): 3.1–3.5 (3.24)	(33): 3.2–4.0 (3.56)
Forewing length	(10): 13.4–18.5 (16.37)	(33): 15.9–22.1 (18.60)
Hind femur length	(9): 13.4–15.8 (14.18)	(28): 14.1–17.0 (15.56)
Cercus length	(10): 1.68–1.84 (1.77)	
Ovipositor length		(31): 9.7–11.5 (10.56)
Pronotum length/fastigium width	(10): 8.8–10.3 (9.38)	(33): 9.0–12.5 (10.63)
Hind femur length/ovipositor length		(26): 1.35–1.57 (1.48)
Sr.all New Ireland form (see below)	Males	Females
Fastigium width	(6): 0.23–0.29 (0.27)	(3): 0.28–0.29 (0.29)
Median length of pronotum	(6): 2.2–3.0 (2.44)	(3): 2.6–2.8 (2.70)
Forewing length	(6): 9.3–13.3 (10.53)	(3): 11.7–13.1 (12.35)
Hind femur length	(4): 9.9–12.5 (10.89)	(3): 11.6–12.3 (11.81)
Cercus length	(5): 1.29–1.64 (1.44)	
Ovipositor length		(3): 8.2–9.1 (8.57)
Pronotum length/fastigium width	(6): 8.0–10.5 (9.22)	(3): 9.3–9.6 (9.41)
Hind femur length/ovipositor length		(3): 1.36–1.41 (1.38)

DISCUSSION. *C. infumatus* closely resembles *C. oceanicus*, *C. starmuehlneri* and *C. redtenbacheri*, in particular the last of these. It can be distinguished from these species by the following combination of characters: the strongly darkened *R* and *Sc* in the forewings (except for small New Ireland form – see below); the fairly gently curved apex of the internal spine of the male cerci, and the high ratio of pronotum length to width of fastigium. The internal spine of the male cerci is

Fig. 49

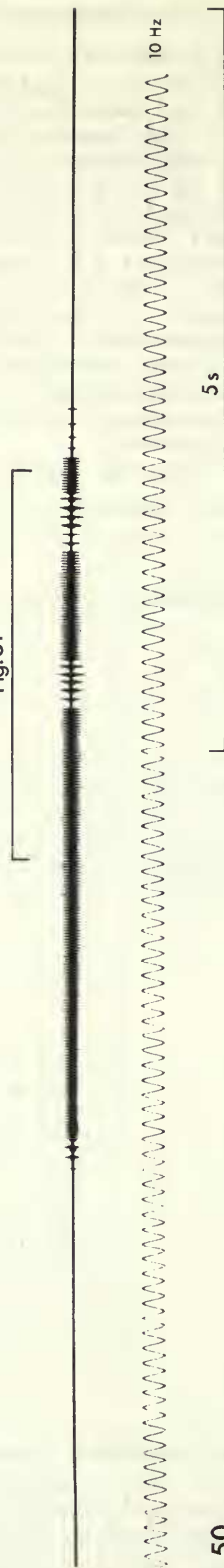


48

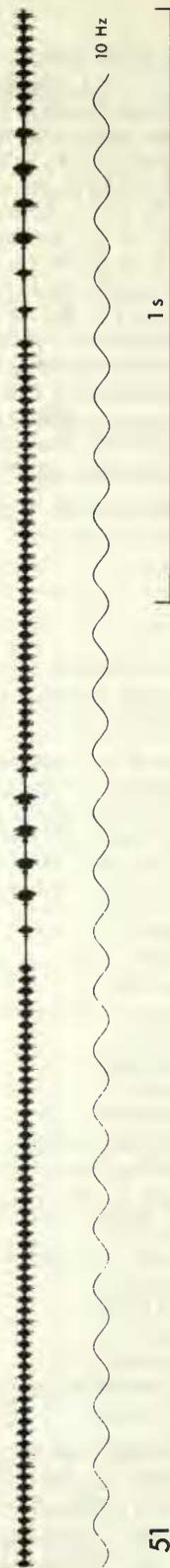


49

Fig. 51



50



51

Figs 48—51 Oscillograms of typical parts of the songs brachypterous specimens of (48, 49) *Conocephalus redtenbacheri*; (50, 51) *C. semivittatus* (typical form); both from New Guinea. The songs were recorded at temperatures of 30°C and 28°C respectively, using a tape speed of 38 cm/s (equipment specified on p. 320).

intermediate in shape between *C. oceanicus* and *C. redtenbacheri*, although slightly closer to the former.

Most of the specimens examined from New Ireland seemed to belong to a small form, distinguishable from the typical form by the following key.

- 1 Comparatively large specimens with dark pigmentation around *R* and *Sc* of the forewings. Hind femur length at least 13.0 mm. Forewing length at least: ♂, 13.4 mm; ♀, 15.9 mm **typical form**
- Comparatively small specimens with fairly weak pigmentation around *R* and *Sc* of the forewings. Hind femur length at most 12.5 mm. Forewing length at most: ♂, 13.3 mm; ♀, 13.1 mm **small New Ireland form**

The existence of two forms of this species is a further complication in considering its status in relation to its three close relatives. Where *C. infumatus* comes in contact with *C. redtenbacheri* in New Britain, the two species are distinct. At the eastern end of the range, however, the speciation appears to be less complete. The small New Ireland form of *C. infumatus* is very similar to some specimens of *C. redtenbacheri* in the Solomon Is., in particular Ontong Java. Most specimens of the small New Ireland form have been found off New Ireland in the Faed Is. of the Nuguria Is., which, like the Ontong Java Is. in the Solomon Is., are a very small, outlying easterly group.

The female holotype of *Xiphidium infumatum* is lost (see Weidner, 1966:243). I have selected a male neotype, as the males of this species are more easily distinguished from related species than the females. The neotype-locality is in New Britain, not far from the original type-locality, the island of Mioko.

One specimen of *C. infumatus* was found to have an internoventral spine on one hind femur.

MATERIAL EXAMINED

Xiphidium infumatum Redtenbacher, neotype ♂, **New Britain**: Gazelle Peninsula, Baining, St Paul's, 350 m, 5.ix.1955 (Gressitt) (BPBM, Honolulu).

Typical form. New Britain: 7 ♂, 9 ♀, Gazelle Peninsula, Baining, St Paul's, 350 m, ix; 1 ♀, G. P., Keravat, ii; 1 ♀, G. P., Upper Warongoi, Illugi, 230 m, xii; 1 ♀, G. P., Warongoi Valley, 100 m, v; 3 ♀, Mosa Plantation, iv-vi; 2 ♀, Mosa Village, iv; 2 ♀, Nakanai Mts, Gisiluve, 1050 m, vii; 1 ♂, 3 ♀, N. M., Silanga, 150 m, vii-viii; 2 ♀, N. M., Talalo, 900 m, vii; 1 ♂, N. M., Ti, vii; 1 ♀, S. coast, Rano Pl'n, iv; 1 ♀, Mt Sinewit, 1070 m, viii; 1 ♀, N. coast, Walo, vii; 2 ♀, W. of Willaumez Peninsula, Linga Linga Pl'n, 1 m, iv. **New Ireland**: 1 ♀, Kandan, xii. **Solomon Is.**: 1 ♀, Bougainville, Kokure, near Crown Prince Range, 900 m, vi. (BMNH; ANIC, Canberra; BPBM, Honolulu; DPI, Konedobu.)

Small New Ireland form. New Ireland: 5 ♂, 3 ♀, Faed Is., x (BMNH; DPI, Konedobu); 1 ♂, Gilingil Pl'n, 2 m, vii (BPBM, Honolulu).

DISTRIBUTION (Fig. 1 and Table 1). This species only occurs in New Britain, New Ireland and the northernmost of the Solomon Is. Previous records of the species from New Guinea refer to specimens which I have not seen but consider likely to be *C. redtenbacheri*.

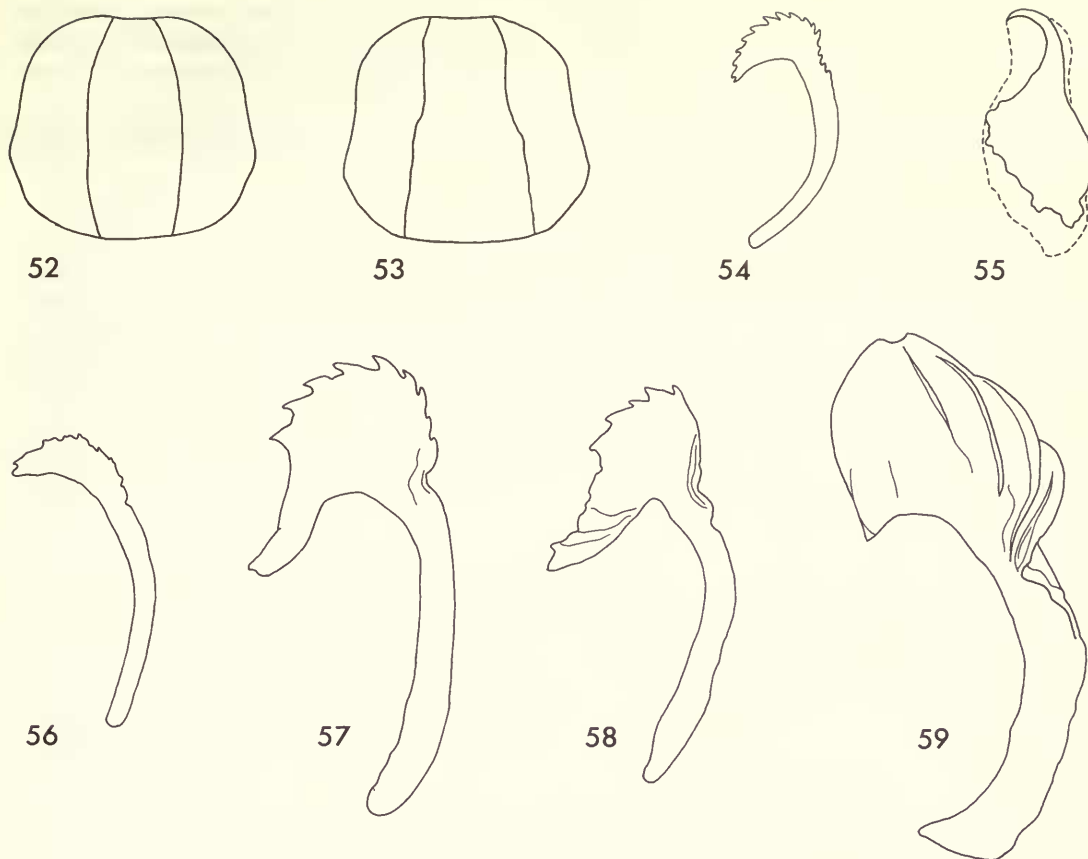
Conocephalus semivittatus (Walker)

(Figs 7-9, 28, 50-53)

Decticus semivittatus Walker, 1869:263.

DIAGNOSIS. ♂ ♀. Fastigium of vertex wide. Prosternum bispinose. Macropterous or brachypterous. Forewings with dark pigmentation in costal and precostal areas, and usually with spot at posterior margin (Fig. 28). Cross-veins of costal and precostal areas of forewings irregular or reduced. Stridulatory file of left male forewing shaped as in Figs 45 and 46. Hind femora with 1-9 externoventral spines. Hind tibiae with 6 apical spurs. Male cerci shaped as in Figs 7-9, with one well-developed internal spine and one tubercle. Female subgenital plate with excised or truncate apex. Ovipositor of short to medium length, relatively straight.

DISCUSSION. *C. semivittatus* resembles *C. tumidus* but differs from it in the shape of the male cerci and usually in the number of hind tibial spurs. Nearly all the females examined had a narrower fastigium of the vertex than those of *C. tumidus*. The excised apex of the female subgenital plate of the nominate subspecies and the typical form of subspecies *vittatus* also distinguishes them from those of *C. tumidus*.



Figs 52–59 52, 53, dorsal view of the pronotum showing the outline of the area of dark pigmentation of (52) *Conocephalus semivittatus semivittatus*; (53) *C. semivittatus vittatus* (typical form). 54–59, dorsal view of the right titillator of (54) *C. tumidus*; (55) *C. angustivertex*; (56) *C. bispinatus* (New Guinea); (57) *C. bispinatus* (Thailand); (58) *C. bispinatus* (Malaya); (59) *C. bispinatus* (Borneo). Surface sculpturing (other than ridges) is omitted.

I have compared the type-series of *Xiphidium* (*Xiphidion*) *brunneri* with the holotype and other material of *C. s. semivittatus* and consider them to be conspecific. The type-series of *brunneri* consists of 1 ♂, 1 ♀, of which I have selected the female as the lectotype as it is in a better state of preservation than the male.

Brachypterous specimens were more common than macropterous specimens by 37 to 26 and usually had rounded forewing apices. One brachypterous female from New Zealand had distinctly pointed forewings though, and the wings were slightly longer than those of the other brachypterous females. This feature has been described by Hudson (1972).

Three of the specimens examined were found to have one or two internoventral spines on one hind femur.

MATERIAL EXAMINED (63 specimens, brachypterous unless otherwise stated)

Decticus semivittatus Walker, holotype ♀, **New Zealand**: Auckland (*Sinclair*) (BMNH). *Xiphidium maoricum* Walker, lectotype ♀, macropterous, **New Zealand** (*Bolton*) (BMNH). *Xiphidium antipodum* Scudder, lectotype ♂, **New Zealand** (*Edwards*) (ANS, Philadelphia). *Xiphidium* (*Xiphidion*) *brunneri* Karny, lectotype ♀, **New Zealand** (*Hutton*) (NM, Vienna).

Australia: macropterous and brachypterous, New South Wales. **Kermadec Is.**: Raoul. **Lord Howe I.**: 1 ♂, 2 ♀, macropterous, 2 ♂, 2 ♀, NSW., ii–iii. **New Zealand**: 1 ♀, macropterous (*Bolton*) (BMNH)

(paralectotype of *Xiphidium maoricum* Walker); 1 ♀, macropterous (Colenso) (BMNH) (*Xiphidium maoricum* Walker, var. B); 1 ♀ (Edwards) (ANS, Philadelphia) (paralectotype of *Xiphidium antipodum* Scudder); 1 ♂ (Hutton) (NM, Vienna) (paralectotype of *Xiphidium (Xiphidion) brunneri* Karny); macropterous and brachypterous, North I. (BMNH; BPBM, Honolulu.)

DISTRIBUTION (Table 1). This subspecies occurs in the south of the species range, extending northwards to Australia: New South Wales.

***Conocephalus semivittatus vittatus* (Redtenbacher) nom. rev., stat. n.**

(Figs 8, 9, 50, 51, 53)

Xiphidium vittatum Redtenbacher, 1891:513. LECTOTYPE, ♂, ARU IS. (NM, Vienna), here designated [examined]. [Synonymized with *Conocephalus maoricus* (Walker) by Karny, 1912:11.]

Xiphidium geniculare Redtenbacher, 1891:527. LECTOTYPE, ♂, ARU IS. (NM, Vienna), here designated [examined]. [Synonymized with *Xiphidium semivittatum* (Walker) by Hutton, 1898:137.]

DIAGNOSIS. ♂ ♀. Dark stripe of dorsum of pronotum shaped as in Fig. 53. Forewings with or without spot on posterior margin (Fig. 28). Male cerci shaped as in Figs 8, 9. Female subgenital plate with excised or truncate apex. Ovipositor short. Song (of typical form) as in oscillograms (Figs 50, 51), consisting of a burst of sound usually lasting 5–6 seconds, occasionally up to 15 seconds. Each burst of sound consists of two alternating types of sound, the longer parts of which have a rate of c. 50 syllables per second, and the considerably shorter parts of which have a rate of 16–20 syllables per second. The songs of brachypterous and macropterous specimens were similar.

MEASUREMENTS

Typical form

	Males	Females
Fastigium width	(47): 0.52– 0.76 (0.65)	(36): 0.52– 0.83 (0.68)
Median length of pronotum	(49): 2.8 – 3.9 (3.31)	(37): 3.0 – 4.0 (3.37)
Forewing length (macropterous)	(19): 18.0 –21.0 (19.35)	(14): 17.3 –21.3 (19.15)
(brachypterous)	(30): 4.0 – 7.5 (5.39)	(21): 2.1 – 4.3 (3.07)
Hind femur length	(39): 13.0 –16.4 (14.70)	(34): 14.2 –16.6 (15.46)
Ovipositor length		(37): 7.2 – 9.3 (8.69)

Small form

	Males	Females
Fastigium width	(14): 0.57– 0.73 (0.66)	(24): 0.63– 0.81 (0.73)
Median length of pronotum	(14): 2.5 – 3.1 (2.89)	(24): 2.9 – 3.3 (3.11)
Forewing length (macropterous)	(2): 18.0 –18.1 (18.05)	(2): 19.1 –19.5 (19.30)
(brachypterous)	(12): 2.5 – 3.6 (3.25)	(19): 1.9 – 3.3 (2.39)
Hind femur length	(12): 11.7 –14.9 (13.22)	(24): 13.0 –15.1 (14.26)
Ovipositor length		(22): 7.3 – 8.3 (7.85)

DISCUSSION. *C. s. vittatus* differs from the nominate subspecies in the shape of the male cerci and the shorter ovipositor. The shape of the dorsal pronotal stripe of the typical form of *C. s. vittatus* also differs from the nominate subspecies; that of the small form is more variable and tends to be intermediate.

The specimens I am referring to as the small form show small but consistent differences from the rest of the subspecies. It is possible that they may prove to belong to a separate species, but this cannot be firmly established on the basis of present knowledge.

This form differs from the typical form of the subspecies, and also from *C. s. semivittatus*, in having no spot of pigmentation on the posterior forewing margin, or at most only a diffuse trace. It also differs from both in the shorter forewings of brachypterous males, the truncate apex of the female subgenital plate and the shape of the male cerci. The male cerci of the typical form of *C. s. vittatus* are more robust than in the others, while those of the small form are on average smaller than those of the other two, and to some extent intermediate in shape between the typical form and *C. tumidus*. The internal cercal spine of the small form is comparatively wider at the base than in the rest of the species.

The small form shares with *C. tumidus* most of the characters distinguishing it from the typical form, while sharing with the typical form the diagnostic features which separate *C. semivittatus* from *C. tumidus*.

Brachypterous specimens of *C. s. vittatus* were very much more common than macropterous, in the ratio of 7 to 1.

Redtenbacher (1891) gives *Xiphidium antipodum* and *X. bilineatum* as possible synonyms of *X. geniculare*. *X. antipodum* is in fact a synonym of *C. s. semivittatus*, and *C. bilineatus* is a valid species. *C. semivittatus* has been regarded as a synonym of *C. bilineatus* by several authors prior to Hudson, 1972, who rightly separated the two species, although she left *X. geniculare* as a synonym of *C. bilineatus*.

Xiphidium geniculare was synonymized with *Xiphidium semivittatum* by Hutton, 1898, but has since been placed as a synonym of *C. bilineatus*. I have examined 4 ♂ adults, 1 ♀ nymph from the type-series of *X. geniculare*, and I agree with the earlier synonymy. In addition to the syntypes examined, from which I have selected a male lectotype, there are specimens from Mioko, New Zealand and 1 ♂ from the Aru Is. which I have not seen. I have also selected a male lectotype from the type-series of *Xiphidium vittatum*, consisting of 1 ♂, 1 ♀ which I have examined, and one or more specimens from New Zealand which I have not seen.

One of the apical spurs was missing on one hind tibia in two specimens examined.

MATERIAL EXAMINED

Xiphidium vittatum Redtenbacher, lectotype ♂, macropterous, **Aru Is. (Ribbe)** (NM, Vienna). *Xiphidium geniculare* Redtenbacher, lectotype ♂, **Aru Is. (Ribbe)** (NM, Vienna).

Typical form (273 Pacific specimens, brachypterous unless otherwise stated). **Admiralty Is.:** 1 ♂, Manus, Lorengau, 1–75 m, vi; 1 ♀, M., near Lorengau, vi; 2 ♀, M., c. 8 km E. of Lorengau, near Lombrum, vi; 2 ♀, M., 6 km SE. of Lorengau, Rossum, 180 m, xii; 1 ♂, M., Rossum, 32–125 m, vi; 1 ♂, 1 ♀, M., Momote, xii. **Australia:** N. Queensland. **Duke of York Group:** 1 ♂, Mioko (between New Britain and New Ireland) (NM, Vienna) (paralectotype of *Xiphidium geniculare* Redtenbacher). **New Britain:** 2 ♂, Akanglo I., near Kandrian, S. coast, iv; 1 ♂, Baronga I., near Lindenhafen, iv; 2 ♂, Gazelle Peninsula, Baining, St Paul's, 350 m, ix; 2 ♂, G. P., Keravat, 60 m, viii; 1 ♂, G. P., 10 km E. of Keravat, Vunabakan, 180 m, xi; 1 ♂, G. P., Upper Warongoi, 250–600 m, xi; 1 ♂, 2 ♀, macropterous, G. P., Warongoi Valley, 100 m, v. **New Guinea:** macropterous and brachypterous, Irian Jaya; macropterous and brachypterous, Papua New Guinea, and associated tape recordings. **New Hebrides:** Banks Is.; Epi; Espiritu Santo; Malekula; Pentecost; Vanua Lava. **N. Ireland:** 1 ♀, SW., Gillingil Pl'n, 2 m, vii. **Solomon Is.:** 1 ♀, Bellona, xi; 1 ♀, B., Henuangoto, x; 1 ♀, macropterous, Biawa, iv; 1 ♂, macropterous, 1 ♂, Bougainville, near Crown Prince Range, Kokure, 900 m, vi; 1 ♂, B., S., Kieta, xi; 1 ♂, B., Mumurai, vi; 2 ♀, B., Teopasino, c. 5° 40' S, 155° 07' E, vi; 1 ♀, Choiseul, Malangona, 10 m, iii; 1 ♂, Guadalcanal, xii; 1 ♂, G., Gold Ridge, iii; 1 ♂, G., Honiara District, Kukum, viii; 2 ♂, G., H. D., Poha R., vii–x; 1 ♂, macropterous, 2 ♂, 2 ♀, G., H. D., Tenaru, v–x; 1 ♂, G., Ruavatu, iv; 4 ♀, 1 ♀, G., Suta, 500–1200 m, vi; 1 ♀, G., Sutakiki R., iv; 2 ♀, G., Tapenanje, xii; 1 ♀, G., Tapenanje, c. 335 m, xii; 1 ♂, Malaita, Auki, 2–20 m, ix; 1 ♂, M., Fulisango-Maegwasu, v; 1 ♂, Rendova, x; 2 ♂, 1 ♀, San Cristobal, Huni R. Mouth, viii; 1 ♂, S. C., Kira-Kira, grass, xi; 1 ♀, Santa Cruz Is., coconut, xi; 1 ♂, 1 ♀, Santa Isabel, Gatere, ii; 1 ♀, S. I., Maringe Lagoon (Lgu' ?), ii; 1 ♂, Western Group, Kolombangara, Kuli, x; 1 ♂, K., 2 km inland from Kuzi, by Kolombangara R., ix. (BMNH; DSIR, Auckland; ANIC, Canberra; BPBM, Honolulu; DPI, Konedobu.)

Extralimital material. **Aru Is.:** 2 ♂ (*Ribbe*) (NM, Vienna) (paralectotypes of *Xiphidium geniculare* Redtenbacher); 1 ♀, macropterous (*Ribbe*) (NM, Vienna) (paralectotype of *Xiphidium vittatum* Redtenbacher). **Kai Archipelago:** Taām. **Moluccas. Philippines. Sulawesi:** Cape Dulang? ('Ke Dulan').

Small form (38 Pacific specimens). **New Guinea:** macropterous and brachypterous, Irian Jaya; macropterous and brachypterous, Papua New Guinea. (BMNH; ANIC, Canberra; BPBM, Honolulu.)

Extralimital material. **Philippines:** macropterous and brachypterous.

DISTRIBUTION (Table 1). This subspecies occurs in the north of the species range extending southwards to Australia: N. Queensland and the New Hebrides. The two forms of *C. s. vittatus* are sympatric, although the small form has a more restricted distribution.

Conocephalus tumidus sp. n.

(Figs 10, 23, 29, 54)

DESCRIPTION AND DIAGNOSIS. ♂ ♀. Fastigium of vertex very wide, usually slightly more than width of basal antennal segment. Prosternum bispinose. Brachypterous. Forewings with dark pigmentation in costal and precostal areas, without spot at posterior margin (Fig. 29). Cross-veins of costal and precostal areas of forewings reduced, irregular. Stridulatory file of left male forewing shaped as in Figs 45 and 46. Hind femora

usually with 1–4 extenroventral spines; one femur sometimes unarmed. Hind tibiae usually with not more than 4 apical spurs (ventral pair missing). In some cases one, or occasionally both, internodorsal apical spurs also missing. Male cerci as in Fig. 10, swollen in middle, with one well-developed internal spine and one tubercle. Titillators as in Fig. 54. Female subgenital plate with truncate apex. Ovipositor short, relatively straight (Fig. 23).

General coloration: mixture of green, reddish brown and dark brown. Head and pronotum with dark brown, dorsal, longitudinal stripe, with light margins on the pronotum. Femora usually with small dark spots. Abdomen sometimes with wide, longitudinal stripes, faintly darker than ground colour.

MEASUREMENTS

	Males	Females
Total length	(5): 11.6 – 13.9 (12.48)	(4): 12.8 – 16.1 (14.40)
Fastigium width	(6): 0.62 – 0.93 (0.72)	(4): 0.83 – 0.91 (0.85)
Median length of pronotum	(6): 2.7 – 3.3 (2.97)	(4): 3.1 – 3.3 (3.19)
Forewing length	(6): 4.9 – 6.1 (5.30)	(4): 2.6 – 3.0 (2.89)
Hind femur length	(5): 10.5 – 13.5 (11.85)	(3): 12.7 – 14.2 (13.40)
Ovipositor length		(4): 7.4 – 8.4 (7.98)

DISCUSSION. *C. tumidus* is similar to *C. semivittatus*, particularly the small form of *C. s. vittatus*. The males can be distinguished by the shape of the cerci, and in most cases by the hind tibial apical spurs. The females can be distinguished by the hind tibial apical spurs together with the wide fastigium of the vertex. The ventral hind tibial apical spurs were absent in all except one of the specimens examined and were often replaced by hairs. The right forewing of the brachypterous males was usually slightly longer (by 0.3 mm on average) than the left forewing.

MATERIAL EXAMINED

Holotype ♂, **New Guinea**: Papua New Guinea, NE., 48 km E. of Kainantu, Kassam, 1350 m, 28.x.1959 (*Maa*) (BPBM, Honolulu).

Paratypes. **New Guinea**: 1 ♂, 1 ♀, Papua New Guinea, Eastern Highlands District, 25 km ENE. of Kainantu, Kassam Pass, 16.ii.1976 (*Farrow*) (ANIC, Canberra); 1 ♂, 1 ♀, P. N. G., Eastern Highlands District, 25 km ENE. of Kainantu, Kassam Pass, 16.ii.1976 (*Farrow*) (BMNH); 1 ♂, P. N. G., NE., 48 km E. of Kainantu, Kassam, 1350 m, 28.x.1959 (*Maa*) (BMNH); 1 ♂, P. N. G., NE., 48 km E. of Kainantu, Kassam, 1350 m, 30.x.1959 (*Maa*) (BPBM, Honolulu); 1 ♀, P. N. G., Morobe District, Ramu-Markham Valley, Gusap Downs Sta., 13.ii.1976 (*Farrow*) (ANIC, Canberra); 1 ♂, 1 ♀, P. N. G., Morobe District, Ramu-Markham Valley, Gusap Downs Sta., 14.ii.1976 (*Farrow*) (ANIC, Canberra).

DISTRIBUTION (Table 1). Known only from north-eastern New Guinea.

Conocephalus trivittatus (Stål)

(Fig. 11)

Xiphidium trivittatum Stål, 1860: 323. LECTOTYPE ♂, SOCIETY IS. (NR, Stockholm), here designated [examined].

DIAGNOSIS. ♂ ♀. Fastigium of vertex moderately wide. Prosternum bispinose. Brachypterous. Forewings with darker pigmentation, sometimes faint, towards the base of the costal and precostal areas. Cross-veins of costal and precostal areas of forewings regular, parallel. Stridulatory file of left male forewing shaped as in Figs 45 and 46. Hind femora unarmed ventrally. Hind tibiae with 6 apical spurs. Male cerci as in Fig. 11, with one well-developed internal spine and one tubercle. Ovipositor of medium length, relatively straight.

MEASUREMENTS

	Male	Female
Fastigium width	0.60	0.69
Median length of pronotum	2.8	3.1
Forewing length	5.2	4.6
Length of stridulatory area	1.04	
Hind femur length	10.5	11.3
Ovipositor length		10.7

DISCUSSION. This species resembles *C. semivittatus* in the form of the male cerci, and forewing pigmentation, and *C. oceanicus* and related species in the subcostal forewing venation and to a lesser

extent, the male cerci. It can be distinguished from these species, however, by the unarmed hind femora. The tubercle of the male cerci is comparatively small.

The lectotype of *Xiphidium trivittatum* was selected from a syntypic series of 1 ♂, 1 ♀.

MATERIAL EXAMINED

Lectotype ♂, **Society Is.:** Tahiti (*Kinb.*) (NR, Stockholm).

Society Is.: 1 ♀, Tahiti (*Kinb.*) (NR, Stockholm) (paralectotype).

DISTRIBUTION (Table 1). Known only from the type-locality.

Conocephalus upoluensis (Karny) **nom. rev., stat. n.** (Figs 12, 30, 41)

Xiphidium modestum Redtenbacher, 1891:510. LECTOTYPE ♂, AUSTRALIA (NM, Vienna), here designated [examined]. [Homonym of *Xiphidium modestum* Bruner, 1891:56.]

Xiphidium (Xiphidion) modestum upoluense Karny, 1907:95. LECTOTYPE ♂, SAMOA (NM, Vienna), here designated [examined]. [Synonymized with *Xiphidium modestum* Redtenbacher by Holdhaus, 1908:11.]

Conocephalus brevixiphus Willemse, 1942:95. Holotype ♀, AUSTRALIA (NM, Basle) [examined]. **Syn. n.**

DIAGNOSIS. ♂ ♀. Fastigium of vertex wide. Prosternum bispinose. Macropterous. Forewings with dark pigmentation in costal and precostal areas and comparatively small dark spots elsewhere; with or without dark line or spot towards base of posterior margin, usually faint if present (Fig. 30); light and dark pigmentation usually not strongly contrasted. Cross-veins of costal and precostal areas of forewings irregular. Stridulatory file of left male forewing shaped as in Figs 45 and 46. Hind femora unarmed ventrally. Hind tibiae usually with 4 apical spurs (ventral pair missing). Male tenth abdominal tergite nearly unmodified or slightly produced at apex but not bent downwards (Fig. 41). Male cerci moderately slender in apical part, with one internal spine and usually with one minute tubercle or slight swelling (Fig. 12). Ovipositor moderately short, relatively straight.

MEASUREMENTS

	Males	Females
Fastigium width	(21): 0.59–0.86 (0.70)	(20): 0.59–0.81 (0.74)
Median length of pronotum	(25): 2.6–3.8 (3.09)	(21): 2.7–3.7 (3.18)
Forewing length	(25): 13.3–22.2 (17.13)	(22): 14.2–23.0 (18.31)
Length of stridulatory area	(20): 1.55–2.19 (1.84)	
Hind femur length	(20): 10.8–15.1 (12.92)	(22): 11.8–16.5 (14.26)
Ovipositor length		(22): 6.8–11.0 (8.93)

DISCUSSION. *C. upoluensis* very closely resembles *C. albescens*, but may be distinguished from it by the shape of the male cerci and tenth abdominal tergite, and the fairly short ovipositor. The dark pigmentation of the forewings of *C. upoluensis* varies from being very faint to being as conspicuous as in *C. albescens*, although the latter species usually has more strongly contrasted light and dark pigmentation. Both species have one internal spine and a minute tubercle on the male cerci, thus being intermediate between species with one internal spine and species with one internal spine and a tubercle. This tubercle is sometimes virtually absent in *C. albescens*, and very occasionally absent in *C. upoluensis*.

The species was originally described as *Xiphidium modestum* by Redtenbacher in July, 1891. I have found this to be a primary homonym of a species described by Bruner in March, 1891, from U.S.A.

Comparison of the type-specimens and other material of *C. brevixiphus* and *C. upoluensis* has shown them to be conspecific. Willemse's description of *C. brevixiphus* refers to a female type, and I therefore regard this specimen as the holotype, despite the fact that it is labelled 'Allotype' and a male paratype is labelled 'Type'. I have selected a lectotype from the 1 ♂, 3 ♀ syntypes of *Xiphidium modestum upoluense*, all of which I have examined. I have also selected a lectotype from the syntype-series of *Xiphidium modestum*. In addition to the specimens listed under material examined, there are syntypes which I have not examined with the following data: Australia: Cape York (Bruner). Fiji: —; Ovalau. Tonga Is.: Tongatapu. The syntypes with the following data are lost (see Weidner, 1966:243): Australia: Peak Downs; Sydney. Samoa. There are also 2 ♂ syntypes which are *C. albescens* and I have listed them under that species.

MATERIAL EXAMINED (175 Pacific specimens)

Xiphidium modestum Redtenbacher, lectotype ♂, **Australia**: Sydney (*Trauenfeld*) (NM, Vienna). *Xiphidium* (*Xiphidium*) *modestum upoluense* Karny, lectotype ♂, **Samoa**: Western, Upolu (*Rechinger*) (NM, Vienna). *Conocephalus brevixiphus* Willemse, holotype ♀, **Australia**: Northern Territory, Marrakai, v.1931 (*Handschin*) (NM, Basle) (mislabelled 'Allotype').

Australia: A. C. T.: New South Wales; Northern Territory; 1 ♂, 1 ♀, N. T., Burnside, v.1931 (*Handschin*) (NM, Basle) (paratypes of *C. brevixiphus* Willemse); 1 ♂, N. T., Katherine, v.1931 (*Handschin*) (NM, Basle) (paratype of *C. brevixiphus* Willemse, mislabelled 'Type'); Queensland; S. Australia; Western Australia. **Cook Is.**: 1 ♂, Niue, Kaimiti Forest, on the firebreak, xi; 1 ♀, N., Vaiea Farm, vii. **Fiji Is.**: 1 ♂ (*Thorey*) (NM, Vienna) (paralectotype of *Xiphidium modestum* Redtenbacher); Aiwa; Kandavu; Komo; Lomaloma; Mango; Matuku; Oneata; Ovalau; Vanua Levu; Vanua Mbalavu; Vanua Vatu; Viti Levu; Waya; Yasawa Group. **Loyalty Is.**: Ouvéa. **New Britain**: 1 ♀, Gazelle Peninsula, Baining, St Paul's, 350 m, ix; 1 ♂, G. P., Gaulim, 140 m, x; 2 ♂, G. P., Keravat, Lowl Agr. Exp. Sta., at light in oilpalm block, v; 1 ♀, Nakanai Mts, Gisiluve, 1050 m, vii. **New Caledonia**: 1 ♀ (*Deyrolle*) (NM, Vienna) (paralectotype of *Xiphidium modestum* Redtenbacher). **New Guinea**: Irian Jaya; Papua New Guinea; 1 ♂, P. N. G., Katow (MHN, Geneva) (paralectotype of *Xiphidium modestum* Redtenbacher). **New Hebrides**: Aneityum; Efate; Erromango; Espiritu Santo; Malekula; Pentecost. **New Ireland**: 1 ♀, Anir I., x. Norfolk I.: 1 ♂; 2 ♀, ii-xii; 1 ♀, 76 m, flying over creek, wet weather, iv; 1 ♀, Emily Bay, ii; 1 ♂, Kingatan, ii. **Samoa**: American, Tutuila; Western, Alafua; W., Savaii; W., Upolu; 3 ♀, W., Upolu (*Rechinger*) (NM, Vienna) (paralectotypes of *Xiphidium* (*Xiphidium*) *modestum upoluense* Karny). **Solomon Is.**: 1 ♂, vii-viii; 1 ♂, Bougainville, N. end, vi; 1 ♀, B., Buin, vi; 1 ♂, 1 ♀, B., Buin (Kangu), 1-50 m, v; 4 ♀, B., Numa Numa, c. 5° 53' S, 155° 15' E, vi; 1 ♀, B., Tokinoitu, 20 m, vi; 1 ♀, Buka, Agric. Sta., xii; 11 ♂, 5 ♀, Guadalcanal, xi-xii; 1 ♂, G., Honiara, ii; 1 ♀, G., Honiara District, viii; 7 ♂, 3 ♀, G., H. D., Ilu, ii-v; 1 ♂, 1 ♀, G., H. D., Tenaru, ii-vii; 2 ♂, G., Kukum, xi-xii; 1 ♀, G., Lunga, viii; 1 ♂, G., R. Poha, 5 m, vii; 1 ♂, G., Savo I., xii; 1 ♂, Malaita, Auki, 2-20 m, ix; 6 ♂, 6 ♀, New Georgia Group, Gizo, 30 m, vii; 2 ♂, 2 ♀, Nggela, Tulagi, ii-iii; 1 ♂, Olu Malau Is. (Three Sisters Is.), iv; 1 ♂, 1 ♀, Ontong Java, Peku, 0-10 m, xii; 1 ♀, Russell Is., Lingatu, vi; 1 ♀, Small Malaita, near Maramasike Passage, xi. **Tonga Is.**: 1 ♂ (MHN, Geneva) (paralectotype of *Xiphidium modestum* Redtenbacher); Eua; Niuatoputapu; Tongatapu. (BMNH; DSIR, Auckland; ANIC, Canberra; BPBM, Honolulu; DPI, Konedobu.)

Extralimital material. **Cocos Keeling Is.** **Lesser Sunda Is.**

DISTRIBUTION (Table 1). This species occurs widely in the Pacific. I have found a record of the species from New Zealand to be a misidentification for *C. albescens*, from the measurements and other characters given.

Conocephalus albescens (Walker)

(Figs 13, 42)

Xiphidium albescens Walker, 1869:275. Holotype ♀, AUSTRALIA (BMNH) [examined].

Xiphidium latifrons Redtenbacher, 1891:526. LECTOTYPE ♀, AUSTRALIA (MHN, Geneva), here designated [examined]. **Syn. n.**

[*Conocephalus modestus* (Redtenbacher); Hudson, 1972:254. Misidentification.]

DIAGNOSIS. ♂ ♀. Fastigium of vertex wide. Prosternum bispinose. Macropterous or brachypterous. Forewings with dark pigmentation in costal and precostal areas, with or without comparatively small dark spots elsewhere (similar to Fig. 30); light and dark pigmentation strongly contrasted. Left forewing, and sometimes right, with small dark line or spot towards base of posterior margin. Cross-veins of costal and precostal areas of forewings irregular. Stridulatory file of left male forewing shaped as in Figs 45 and 46. Hind femora unarmed ventrally. Hind tibiae usually with 4 apical spurs (ventral pair missing). Male tenth abdominal tergite with apex produced perpendicularly downwards (Fig. 42). Male cerci very slender in apical part, with one internal spine and one minute tubercle or swelling which is sometimes absent (Fig. 13). Ovipositor long, relatively straight.

MEASUREMENTS

	Males		Females	
Fastigium width	(30): 0.65-0.77	(0.71)	(28): 0.68-0.95	(0.77)
Median length of pronotum	(31): 2.9-3.4	(3.12)	(27): 2.8-3.6	(3.23)
Forewing length (macropterous)	(27): 15.1-18.5	(16.48)	(22): 15.7-19.6	(17.44)
(brachypterous)	(4): 8.5-11.0	(9.95)	(5): 8.0-9.7	(8.68)

	Males	Females
Length of stridulatory area (macropterous)	(26): 1.87– 2.14 (1.99)	
(brachypterous)	(4): 1.58– 1.85 (1.70)	
Hind femur length	(26): 11.6 –13.9 (12.54)	(27): 12.3 –17.0 (14.21)
Ovipositor length		(26): 11.8 –17.1 (13.95)

DISCUSSION. This species is very similar to *C. upoluensis*, differing, however, in the shape of the male cerci and tenth abdominal tergite, and the long ovipositor. Two of the syntypes of *Xiphidium modestum* (name replaced by *C. upoluensis* q. v.) are *C. albescens*, and *C. albescens* has been mistaken in the subsequent literature for *C. upoluensis*.

Of the specimens examined 84% were macropterous, including the holotype of *Xiphidium albescens*. The type-specimens of *Xiphidium latifrons* are brachypterous. I have synonymized these two names since their type-specimens are otherwise morphologically identical. I have selected a lectotype from the two female syntypes of *X. latifrons* I have examined. The rest of the syntype-series, consisting of at least one male from Australia: Sydney, is lost (see Weidner, 1966:243).

MATERIAL EXAMINED (macropterous unless otherwise stated)

Xiphidium albescens Walker, holotype ♀, **Australia:** South Australia (*Bakewell*) (BMNH). *Xiphidium latifrons* Redtenbacher, lectotype ♀, brachypterous, **Australia:** New South Wales, Clarence River (MHN, Geneva).

Australia: 1 ♂, New South Wales (*Thorey*) (NM, Vienna) (paralectotype of *Xiphidium modestum* Redtenbacher); 22 ♂, 30 ♀, N. S. W., Cabramatta, i–xii; 1 ♂, 2 ♀, N. S. W., Cabramatta, Georges R. Valley, i; 1 ♂, N. S. W., Blue, Wentworth Falls, iii; 1 ♂, brachypterous, N. S. W., Canley Vale, ii; 1 ♀, N. S. W., Casula, iii; 1 ♀, brachypterous, N. S. W., Clarence River (MHN, Geneva) (paralectotype of *Xiphidium latifrons* Redtenbacher); 1 ♂, brachypterous, N. S. W., Coonabarabran, i; 1 ♀, N. S. W., Deep Creek, Waitpinga, ii; 1 ♂, 1 ♀, brachypterous, N. S. W., Narrabri, iii; 2 ♀, brachypterous, N. S. W., near Sydney, Gundaman, National Park, iv; 1 ♂, N. S. W., Villawood, iii; 1 ♂, brachypterous, Queensland, near Brisbane, Mogill, ix (BPBM, Honolulu). **Lord Howe I:** 1 ♂ (*Stevens*) (NM, Vienna) (paralectotype of *Xiphidium modestum* Redtenbacher). **New Zealand:** 1 ♀, brachypterous, Northland, 48 km W. of Whangarei, Tangowahine, iv (BPBM, Honolulu). (In BMNH unless otherwise stated.)

DISTRIBUTION (Table 1). Known only from east to south-eastern Australia, Lord Howe I. and New Zealand.

Conocephalus bilineatus (Erichson)

(Fig. 14)

Xiphidium bilineatum Erichson, 1842:249. Holotype ♂, AUSTRALIA (MNHU, Berlin) [examined].

Xiphidium immaculatum Karny, 1911:343. Holotype ♀, AUSTRALIA (NM, Vienna) [examined]. **Syn. n.**

DIAGNOSIS. ♂ ♀. Fastigium of vertex of medium width. Prosternum bispinose. Macropterous or brachypterous. Forewings with darker pigmentation in the costal and precostal areas as in Fig. 29. Cross-veins of costal and precostal areas of forewings fairly irregular. Hind femora unarmed ventrally. Hind tibiae with 4 apical spurs (ventral pair missing). Male cerci as in Fig. 14, with one internal spine. Ovipositor of medium length, relatively straight.

MEASUREMENTS

	Males	Females
Fastigium width	(3): 0.47– 0.57 (0.51)	(3): 0.52– 0.55 (0.53)
Median length of pronotum	(2): 2.8 – 3.0 (2.85)	(3): 2.8 – 3.3 (3.03)
Forewing length (macropterous)	(1): 15.0	(2): 14.5 –17.0 (15.75)
(brachypterous)	(2): 5.0 – 5.2 (5.10)	(1): 2.3
Length of stridulatory area (brachypterous)	(1): 1.7	
Hind femur length	(2): 10.5 –11.6 (11.05)	(3): 11.7 –12.7 (12.20)
Ovipositor length		(3): 10.5 –10.6 (10.57)

DISCUSSION. This species has features in common with *C. albescens* and *C. upoluensis*, but it is distinguished from them by the narrower fastigium of the vertex together with the forewing pigmentation, and by the shape of the male cerci. The forewing pigmentation is sometimes very faint. Macropterous and brachypterous specimens were equally represented in the small sample examined.

Comparison of the holotype and other material of *C. bilineatus* and *Xiphidion immaculatum* has shown them to be conspecific, differing only in that the former is brachypterous and the latter is macropterous.

MATERIAL EXAMINED (macropterous unless otherwise stated)

Xiphidium bilineatum Erichson, holotype ♂, brachypterous, **Australia**: Tasmania (*Schayer*) (MNHU, Berlin). *Xiphidion immaculatum* Karny, holotype ♀, **Australia**: Victoria, Dandenong Ranges (NM, Vienna).

Australia: 1 ♀, Capital Territory, Mt Gingera, Snowy Flat, 1520 m, i (BMNH); 1 ♂, brachypterous, New South Wales, Forest Reefs (BMNH); 1 ♀, brachypterous, Tasmania, Swansea (BMNH). **New Zealand**: 1 ♂, South I., Tasman Valley, Glentanner Station, 610 m, tussock grass and low plants on arid hillside, ii (BMNH).

DISTRIBUTION (Table 1). This species is known only from south-eastern Australia and New Zealand.

Conocephalus maculatus (Le Guillou)

(Figs 15, 31)

Xiphidion maculatum Le Guillou, 1841:294. Holotype or syntypes, SULAWESI: Makassar (lost). NEOTYPE ♂, WEST MALAYSIA (BMNH), here designated [examined].

Locusta (Xiphidium) lepida de Haan, 1842:189. LECTOTYPE ♂, JAVA (RNH, Leiden), here designated [examined]. [Synonymized by Redtenbacher, 1891:515.]

Xiphidium continuum Walker, 1869:271. Holotype ♀, SIERRA LEONE (BMNH) [examined]. **Syn. n.**

Xiphidion neglectum Bruner, 1920:123, Holotype ♂, CAMEROUN (ANS, Philadelphia) [examined]. **Syn. n.**

DIAGNOSIS. ♂ ♀. Fastigium of vertex moderately wide. Prosternum bispinose. Macropterous. Forewings pigmented with comparatively large dark spots; no markings in costal and precostal areas (Fig. 31). Cross-veins of costal and precostal areas of forewings irregular to almost regular. Stridulatory file of left male forewing shaped as in Fig. 47. Hind femora unarmed ventrally. Tibiae marked with spot towards base, dark on mid tibiae, often faint on others. Hind tibiae with 6 apical spurs. Male cerci as in Fig. 15, with one internal spine. Ovipositor very short, relatively straight.

MEASUREMENTS

	Males	Females
Fastigium width	(20): 0.51–0.72 (0.59)	(21): 0.62–0.72 (0.66)
Median length of pronotum	(20): 2.7–3.3 (2.97)	(22): 2.9–3.4 (3.13)
Forewing length	(20): 13.0–19.0 (15.70)	(21): 14.9–21.4 (17.64)
Length of stridulatory area	(23): 1.49–1.92 (1.75)	
Hind femur length	(20): 11.2–14.3 (12.84)	(20): 12.6–15.8 (14.02)
Ovipositor length		(22): 6.6–8.2 (7.33)

DISCUSSION. *C. maculatus* may be easily recognized by the distinctive pigmentation, particularly of the forewings.

I believe the type-specimen(s) of *Xiphidion maculatum* to be lost since they are not in the original depositary (MNHN, Paris). Supposed type-specimens of this were sent to me by Dr Donskoff of the MNHN, Paris, but differed irreconcilably from the description. I have selected a male neotype from West Malaysia in preference to any specimens available from nearer the original type-locality in Sulawesi, since the West Malaysian specimen is in a better state of preservation.

The type-series of *Locusta (Xiphidium) lepida* consists of 1 ♂, 1 ♀, of which I have examined the male and selected it as the lectotype.

Redtenbacher (1891:515) listed *Xiphidium continuum* as a possible synonym of *Xiphidium maculatum*. I have compared the holotype of *X. continuum* with the neotype and many other specimens of *C. maculatus* and confirm the synonymy, although the holotype of *X. continuum* has a narrower fastigium of the vertex (0.49 mm) than the specimens examined from the Pacific.

Comparison of the holotype of *Xiphidion neglectum* with the neotype of *C. maculatus* has shown them to be conspecific, confirming the unpublished opinion of my colleague Mr J. Huxley. *X. neglectum* has a slightly narrower fastigium (0.46 mm) than the Pacific material I have examined, and the pigmentation is rather pale but there are no differences warranting a separate specific identity.

Xiphidium sinense Walker (1871:35) was synonymized with *C. maculatus* by Hebard (1922a:243). I have examined the two male syntypes of the former, from Hong Kong and China, and found one (from Hong Kong) to be *C. maculatus* and the other (from China) to be a clearly different species. I am here designating the male from China as LECTOTYPE, so that *X. sinense* (sp. rev.) is no longer synonymous with *C. maculatus*.

MATERIAL EXAMINED

Xiphidium maculatum Le Guillou, neotype ♂, **West Malaysia**: Klang Gates, 25.ii.1934 (Miller) (BMNH). *Locusta* (*Xiphidium*) *lepida* de Haan, lectotype ♂, **Java** (RNH, Leiden). *Xiphidium continuum* Walker, holotype ♀, **Sierra Leone** ('pres. Morgan') (BMNH). *Xiphidium neglectum* Bruner, holotype ♂, **Cameroun**: Batanga, iv.1914 (Hope) (ANS, Philadelphia).

Australia: 1 ♂, Northern Territory, 7 km ESE. of Nhulunbuy, 12° 17' S, 136° 50' E, v; 1 ♂, 4 ♀, Queensland, Cairns; 1 ♂, Q., Cairns, Freshwater Creek, ii; 1 ♂, Q., Redlynch, ix. **New Guinea**: 2 ♂, 1 ♀, Irian Jaya, Kulima, 1400 m, ii; 1 ♂, 1 ♀, I. J., Swart Valley, W. side, 1400–2000 m, xi; 1 ♂, 2 ♀, I. J., W. of Swart Valley, Kutsime, 1500 m, xi; 1 ♂, 2 ♀, I. J., Wamena, 1700 m, ii; 1 ♀, Papua New Guinea, Aiyura, xii; 1 ♂, 1 ♀, P. N. G., Asaro V., Miramar, 1800 m, vi; 2 ♀, P. N. G., Bena R., 1500–1550 m, ix; 1 ♂, P. N. G., Bisianumu, viii; 1 ♀, P. N. G., Central District, 2 km NW. of Bomana War Cemetery, 9° 24' S, 147° 14' E, iv; 1 ♀, P. N. G., C. D., Brown River, Karema, 9° 12' S, 147° 14' E, viii; 1 ♂, P. N. G., C. D., Idlers Bay (picnic area), 9° 29' S, 147° 05' E, iv; 1 ♂, P. N. G., C. D., E. of Port Moresby, Otomata Plantation, 1 m, xi; 1 ♂, 2 ♀, P. N. G., C. D., Sogeri Plateau, 4 km SSE. of Iorowari, 9° 27' S, 147° 26' E, iv–vii; 1 ♂, 1 ♀, P. N. G., Chimbu District, Bomai, vi; 1 ♀, P. N. G., Finschhafen, iv; 1 ♀, P. N. G., Garaina, 830 m, i; 3 ♀, P. N. G., Goroka, 1550 m, v–vi; 2 ♀, P. N. G., 24 km E. of Kainantu, viii; 1 ♀, P. N. G., 30 km S. of Kainantu, Sinofi, 1590 m, x; 1 ♂, P. N. G., Lae, vii; 1 ♀, P. N. G., Maprik, x; 4 ♂, 3 ♀, P. N. G., Morobe District, Gusap Downs Sta., Ramu-Markham Valley, ii; 1 ♀, P. N. G., M. D., Wau, 1200 m, iv; 1 ♀, P. N. G., Musgrave R., near Javarere, Daradae, x; 1 ♂, 1 ♀, P. N. G., 9 km N. of Port Moresby, 9° 25' S, 147° 08' E, iv; 1 ♀, P. N. G., Port Moresby, Lawes Rd, at lights, iii; 1 ♀, P. N. G., Sepik District, Dreikikir, 350 m, vi; 1 ♂, P. N. G., Subitana-Musgrave District, iv; 5 ♂, 3 ♀, P. N. G., Swart Valley, Karubaka, 1450 m, xi; 1 ♂, P. N. G., Western District, Daru, 9° 05' S, 143° 12' E, v; 1 ♂, 1 ♀, P. N. G., W. D., Lake Murray (Patrol Post), iv; 1 ♂, P. N. G., W. D., Mabaduan, x; 1 ♀, P. N. G., W. D., 2–3 km S. of Morehead, 8° 44' S, 141° 38' E, viii; 1 ♂, P. N. G., W. D., 6 km N. of Morehead, 8° 39' S, 141° 38' E, ix; 1 ♀, P. N. G., W. D., R. Morehead, Rouku, iii–v; 1 ♂, P. N. G., W. D., Oriomo Govt Sta., x; 3 ♂, 1 ♀, P. N. G., W. Highlands, Mt Hagen Valley, Keltiga, 1710 m, ix–x. (BMNH; ANIC, Canberra; BPBM, Honolulu; DPI, Konedobu.)

Extralimital material. **Ethiopian Region. Malagasian Region. Hong Kong**, 1 ♂ ('pres. Bowring') (BMNH) (paralectotype of *Xiphidium sinense* Walker). **West Malaysia. Indonesia. Philippines.**

DISTRIBUTION (Table 1). This species is widely distributed throughout the tropical regions of the Old World, its range extending eastwards to Australia and New Guinea.

Conocephalus laetus (Redtenbacher)

(Figs 16, 39)

Xiphidium laetum Redtenbacher, 1891:514. Holotype ♀, AUSTRALIA (NM, Vienna) [examined].

Conocephalus dubius Willemse, 1942:95. Holotype ♂, AUSTRALIA (NM, Basle) [examined]. **Syn. n.**

Conocephalus raggei Harz, 1970:194. Holotype ♂, UGANDA (BMNH) [examined]. **Syn. n.**

DIAGNOSIS. ♂ ♀. Fastigium of vertex moderately narrow. Prosternum bispinose. Macropterous. Forewings unicolorous. Cross-veins of costal and precostal areas of forewings irregular. Stridulatory area of left male forewing large (Fig. 39). Stridulatory file of left male forewing shaped as in Fig. 47. Hind femora unarmed ventrally. Hind tibiae with 6 apical spurs. Male cerci as in Fig. 16, with one internal spine. Ovipositor long, straight.

MEASUREMENTS

	Males	Females
Fastigium width	(10): 0.42–0.52 (0.46)	(12): 0.47–0.52 (0.51)
Median length of pronotum	(11): 3.1–3.4 (3.26)	(14): 3.3–4.2 (3.68)
Forewing length	(11): 19.1–22.2 (20.75)	(14): 21.7–26.6 (24.03)
Length of stridulatory area	(10): 2.72–3.20 (3.00)	
Hind femur length	(9): 12.6–15.5 (13.94)	(12): 14.7–18.5 (16.29)
Ovipositor length		(14): 13.7–17.7 (15.30)

DISCUSSION. The large stridulatory area of the left male forewing and the long ovipositor distinguish *C. laetus* from the other species included in the present study with unicolorous forewings and unarmed hind femora.

The type-specimens of *C. dubius* and *C. raggei* were compared with the holotype and other material of *C. laetus*, and were found to be conspecific with them, despite the wide geographical separation. The holotype of *C. raggei* has a forewing length of 18.7 mm, slightly shorter than in any of the Pacific specimens examined, but shows no other morphological differences.

C. laetus closely resembles *C. gladius* (Redtenbacher), an oriental species which does not occur in the Pacific. I have found no consistent character for separating these two species. The main difference between them is in the ovipositor, which is considerably longer in *C. gladius*, and wing length, which is shorter in *C. gladius*. Many Oriental and Austro-oriental specimens which I have examined have both short wings (as in *C. gladius*) and a short ovipositor (as in *C. laetus*) or vice versa. The fastigium of the vertex of these specimens varies in width. In *C. laetus* the fastigium is moderately narrow, and it appears to be variable in *C. gladius*. I have omitted the specimens of doubtful identity from the list of material examined.

A minute, barely discernible, pointed swelling is sometimes present on the male cerci, at the base of the internal spine.

MATERIAL EXAMINED (25 Pacific specimens)

Xiphidium laetum Redtenbacher, holotype ♀, **Australia**: Queensland, Port Curtis ('Damel ded., coll. Br. v. W.') (NM, Vienna). *Conocephalus dubius* Willemse, holotype ♂, **Australia**: Northern Territory, Burnside, iv.1931 (*Handschin*) (NM, Basle). *Conocephalus raggei* Harz, holotype ♂, **Uganda**: Lake George, short grass plains, iii.1936 (*Johnston*) (BMNH).

Australia: 1 ♀, Northern Territory, Burnside, iv.1931 (*Handschin*) (NM, Basle) (allotype of *Conocephalus dubius* Willemse); Queensland (BMNH; BPBM, Honolulu). **New Guinea**: 1 ♂, 1 ♀, Irian Jaya, Sentani, 90+ m, vi (BMNH); 1 ♀, Papua New Guinea, Bululu, 800–900 m, xi (BPBM, Honolulu); 1 ♂, P. N. G., Kokoda, 370 m, viii (BMNH); 2 ♂, 1 ♀, P. N. G., Morobe District, Gusap Downs Sta., Ramu-Markham Valley, ii (ANIC, Canberra); 1 ♂, P. N. G., Morobe District, Gusap Downs Sta., Ramu-Markham Valley, ii (BMNH); 1 ♂, P. N. G., Tapini, v (BPBM, Honolulu); 2 ♂, 1 ♀, P. N. G., Western District, Daru, 9° 05' S, 143° 12' E, viii (ANIC, Canberra); 1 ♀, P. N. G., W. D., Morehead, 8° 43' S, 141° 38' E, viii (ANIC, Canberra).

Extralimital material. **Celebes**. **N. Moluccas**. **Philippines**. **Central African Republic**. **Mali** (including 6 ♂, 1 ♀, paratypes of *C. raggei* Harz). **Nigeria** (including 1 ♀ paratype of *C. raggei* Harz). **Uganda** (including 4 ♂, 6 ♀ paratypes of *C. raggei* Harz). **Zaire** (1 ♂, 8 ♀ paratypes of *C. raggei* Harz).

DISTRIBUTION (Table 1). In the area of the present study, this species was previously known from Australia, and has been recorded from the New Hebrides although I have not seen specimens from there; it has now also been found in New Guinea. It occurs west of the Pacific in the Austro-Oriental Region, in tropical Africa, and possibly in the Oriental Region. This is a similar distribution pattern to that of *C. maculatus* which is, however, a much more common species.

Conocephalus angustivertex sp. n.

(Figs 17, 24, 32, 55)

DESCRIPTION AND DIAGNOSIS. ♂ ♀. Fastigium of vertex narrow, slightly less than half width of basal antennal segment. Prosternum bispinose. Macropterous or brachypterous. Forewings with broad band of dark pigmentation as in Fig. 32, and pigmentation in costal and precostal areas. Cross-veins of costal and precostal areas of forewings moderately irregular. Stridulatory file of left male forewing shaped as in Fig. 47. Hind femora with 1–8 externoventral spines, and frequently with 1–4 internoventral spines. Hind tibiae usually with 5 apical spurs (internodorsal spur missing or, exceptionally, present but small). Male tenth abdominal tergite with two comparatively large median projections at apex. Male cerci as in Fig. 17, with one internal spine. Titillators as in Fig. 55; weakly sclerotized. Female subgenital plate with excised apex. Ovipositor moderately short, gently curved (Fig. 24).

General coloration brown, with wide dark brown stripe along top of body from fastigium of vertex to end of abdomen. Abdomen, and usually pronotum, with lateral stripes, occasionally fusing with dorsal stripe; lateral stripes often slightly lighter than dorsal stripe although darker than ground colour. Lateral pronotum stripes narrower than dorsal stripe. Femora frequently with small dark brown or reddish spots.

MEASUREMENTS

	Males	Females
Total length (macropterous)	(4): 26.2 – 29.5 (28.25)	(9): 28.3 – 31.9 (29.71)
(brachypterous)	(6): 11.3 – 15.0 (12.60)	(7): 13.5 – 14.7 (14.01)
Fastigium width	(11): 0.27 – 0.36 (0.31)	(16): 0.27 – 0.38 (0.33)
Median length of pronotum	(11): 2.8 – 3.2 (2.95)	(16): 3.0 – 3.3 (3.10)
Forewing length (macropterous)	(4): 18.4 – 21.2 (20.14)	(9): 20.0 – 23.8 (21.21)
(brachypterous)	(7): 3.1 – 4.1 (3.69)	(7): 2.1 – 4.1 (2.48)
Hind femur length	(10): 12.5 – 14.4 (13.39)	(14): 13.7 – 14.7 (14.16)
Ovipositor length		(16): 7.9 – 9.2 (8.42)

DISCUSSION. *C. angustivertex* may be distinguished from all other species of the genus by the absence of the internodorsal hind tibial spurs, together with the shape of the male cerci and female ovipositor, and the forewing pigmentation. Macropterous and brachypterous specimens were nearly equally represented in the sample studied. The right forewing of the brachypterous males was usually slightly longer (by 0.4 mm on average) than the left forewing. The brachypterous specimens had rounded forewing apices with the exception of one female with sharply pointed forewings which were longer than those of the other brachypterous females. One shrivelled, possibly teneral, male specimen had colourless forewings.

MATERIAL EXAMINED

Holotype ♂, macropterous, **New Guinea**: Papua New Guinea, 24 km S. of Paup, Torricelli Mts, 520 m, 4–11.iii.1939 (*Moore*) (BMNH).

Paratypes. **New Guinea**: 1 ♀, macropterous, Irian Jaya, 40 km N. of Baliem Valley, Bokondini, c. 1300 m, 16–23.xi.1961 (*Quate*) (BPBM, Honolulu); 1 ♂, 1 ♀, brachypterous, I. J., Mt Cyclops, 1070 m, iii.1936 (*Cheesman*) (BMNH); 2 ♀, brachypterous, I. J., Cyclops Mts, Mt Lina, 1070 m, iii.1936 (*Cheesman*) (BMNH); 2 ♂, 4 ♀, brachypterous, I. J., Cyclops Mts, Mt Lina, 1070–1370 m, iii.1936 (*Cheesman*) (BMNH); 1 ♂, brachypterous, Papua New Guinea, Eastern Highlands District, 25 km ENE. of Kainantu, Kassam Pass, 16.ii.1976 (*Farrow*) (ANIC, Canberra); 1 ♂, brachypterous, P. N. G., NE., Swart Valley, Karubaka, 1450 m, 5.xi.1958 (*Gressitt*) (BPBM, Honolulu); 1 ♀, macropterous, P. N. G., NE., Upper Jimmi Valley, Tsenga, 14.vii.1955 (*Gressitt*) (BPBM, Honolulu); 1 ♂, brachypterous, P. N. G., NE., Upper Jimmi Valley, Tsenga, 1200 m, 15.vii.1955 (*Gressitt*) (BPBM, Honolulu); 1 ♂, macropterous, P. N. G., NE., Upper Jimmi Valley, Wana, 1500 m, 11.vii.1955 (*Gressitt*) (BPBM, Honolulu); 1 ♂, brachypterous, P. N. G., NE., Wana, Korop, 1500 m, 12.vii.1955 (*Gressitt*) (BPBM, Honolulu); 2 ♂, 6 ♀, macropterous, P. N. G., 24 km S. of Paup, Torricelli Mts, 520 m, 4–11.iii.1939 (*Moore*) (BMNH); 1 ♀, macropterous, P. N. G., Torricelli Mts, Afua, 15–30 m, 2.iv.1939 (*Moore*) (BMNH).

DISTRIBUTION (Table 1). Known only from New Guinea.

Conocephalus saltator (Saussure)

(Figs 18, 36, 38, 40, 44)

Xiphidium saltator Saussure, 1859:208. Holotype ♀, GUYANA (MHN, Geneva) [examined].

Xiphidium meridionale Scudder, 1875:460. Holotype ♀, BRAZIL (ANS, Philadelphia) [examined].

[Synonymized by Rehn & Hebard, 1915b:269.]

Xiphidium propinquum Redtenbacher, 1891:522. LECTOTYPE ♂, ST VINCENT (BMNH), here designated [examined]. [Synonymized by Rehn & Hebard, 1915b:269.]

Xiphidium brachypterum Redtenbacher, 1891:523. LECTOTYPE ♂, BRAZIL (NM, Vienna), here designated [examined]. [Synonymized by Rehn & Hebard, 1915b:269.]

Xiphidium varipenne Swezey, 1905:212. LECTOTYPE ♂, HAWAIIAN IS. (HSDA, Honolulu), here designated [examined]. [Synonymized by Hebard, 1922b:347.]

DIAGNOSIS. ♂ ♀. Fastigium of vertex of medium width. Prosternum bispinose. Macropterous or brachypterous. Forewings unicolorous. Cross-veins of costal and precostal areas of forewings moderately regular and parallel. *MA* of forewings shaped as in Fig. 36. Stridulatory file of left male forewing shaped as in Fig. 47. Hind femora comparatively sharply swollen towards base (Fig. 38); with 1–6 externoventral spines, or occasionally unarmed. Hind tibiae with 6 apical spurs (Fig. 40). Male cerci shaped as in Fig. 18, with one internal spine. Female subgenital plate with truncate apex (Fig. 44). Ovipositor of medium length, relatively straight.

MEASUREMENTS

	Males			Females		
Fastigium width	(31):	0.42–	0.63 (0.51)	(20):	0.44–	0.63 (0.56)
Median length of pronotum	(31):	2.7 –	3.4 (3.04)	(20):	3.1 –	3.9 (3.41)
Forewing length (macropterous)	(9):	13.9 –	20.0 (18.06)	(4):	17.0 –	20.1 (18.99)
(brachypterous)	(19):	4.5 –	8.2 (6.06)	(14):	3.5 –	12.3 (5.28)
Length of stridulatory area (macropterous)	(11):	1.37–	1.47 (1.39)			
(brachypterous)	(18):	1.01–	1.27 (1.16)			
Hind femur length	(23):	10.7 –	14.8 (12.89)	(18):	11.0 –	15.4 (14.51)
Ovipositor length				(21):	10.7 –	13.2 (11.79)

DISCUSSION. *C. saltator* differs from all the other species in the present study in the shape of the male cerci, with the internal spine positioned towards the base. The species is of Neotropical origin and has no close relatives in the Pacific. The females, however, are similar in appearance to those of *C. longipennis* and *C. oceanicus*. They may be distinguished particularly from the former by the truncate apex of the subgenital plate. Females of *C. saltator* also differ from *C. longipennis* in the fastigium width, and from *C. oceanicus* in the shape of the hind femora and the forewing venation.

The male cerci of *C. saltator* show some variation in length. The shape of the male cerci gives rise to a slight rounded swelling above the base of the internal spine. One specimen examined had only five apical spurs on one hind tibia due to the fusion of one ventral and one lateral spur.

I have selected a lectotype from the 2 ♂ syntypes of *Xiphidium propinquum* I have examined. There are additional syntypes from Guatemala (*Dohrn*) and Venezuela: Merida (*Brunner*), which I have not seen. I have also selected a male lectotype from the 2 ♂, 1 ♀ syntypes of *Xiphidium brachypterum* I have examined. The length of the stridulatory area of this specimen is 1.38 mm, longer than in the brachypterous Pacific specimens examined. There are other syntypes of this species which I have not examined: Brazil: 1 ♂; Colombia: 1 ♀; Venezuela: 1 ♀ (all NM, Vienna); Peru: 1 ♀ (MHN, Geneva).

I have selected a lectotype from 3 ♂, 1 ♀ specimens examined which I consider to be probable syntypes of *Xiphidium varipenne*. This was described from 'numerous specimens collected in Honolulu and elsewhere in the Hawaiian Islands'.

The holotype of *Xiphidium saltator* has an ovipositor length of 10.0 mm, shorter than in the Pacific specimens examined.

MATERIAL EXAMINED (52 Pacific specimens, brachypterous unless otherwise stated)

Xiphidium saltator Saussure, holotype ♀, macropterous, **Guyana** (MHN, Geneva). *Xiphidium meridionale* Scudder, holotype ♀, **Brazil** (*Janson*) (ANS, Philadelphia). *Xiphidium propinquum* Redtenbacher, lectotype ♂, **Windward Is.**: St Vincent, Windward side (*Smith*) (BMNH). *Xiphidium brachypterum* Redtenbacher, lectotype ♂, **Brazil**: Rio de Janeiro, Cachoeira (*Meyer-Düry*) (NM, Vienna). *Xiphidium varipenne* Swezey, lectotype ♂, **Hawaiian Is.**: Oahu, Mt Tantalus, 400 m, vii–x.1904 (*Giffard*) (HSDA, Honolulu).

Cook Is.: 1 ♂, macropterous, Mangaia, coast; 1 ♂, macropterous, M., Makatea; 1 ♀, macropterous, M., Makatea, coast; 1 ♂, Rarotonga, Ngatangia, x; Temakatea. **Hawaiian Is.**: macropterous and brachypterous, Oahu; 2 ♂, 1 ♀, macropterous, O., Mt Tantalus, 400 m, vii–x.1904 (*Giffard*) (HSDA, Honolulu) (paralectotypes of *Xiphidium varipenne* Swezey). **Line Is.**: 2 ♂, 1 ♀, Palmyra, camp and airstrip area, 2–3 m, iii. **Samoa**: 1 ♂, American, Manua Is., Tau I., E. Tau Village (Luma), 50–200 m, ii; 1 ♀, A., Tutuila, viii; 1 ♂, A., T., near Alao, vi; 1 ♂, A., T., Aua-Afono Trail, ii; 1 ♀, A., T., Fagatoga Tr., reservoir, iii; 1 ♀, A., T., Pango Pango, north side, viii; 1 ♂, Western, Alafua, ii; 1 ♂, W., Savaii, Asau, i; 1 ♂, W., Upolu, ii; 1 ♀, macropterous, 1 ♂, 1 ♀, W., U., Apia, ii–vi; 1 ♂, 1 ♀, W., U., Sliding Rock, iv; 1 ♀, macropterous, 1 ♀, W., U., Utumapu, xii. (BMNH; DSIR, Auckland; ANIC, Canberra; BPBM, Honolulu.)

Extralimital material. Neotropical Region, macropterous and brachypterous; **Brazil**: 1 ♂ (NM, Vienna) (paralectotype of *Xiphidium brachypterum* Redtenbacher); **Peru**: 1 ♀ (MHN, Geneva) (paralectotype of *Xiphidium brachypterum* Redtenbacher); **Windward Is.**: 1 ♂, St Vincent (*Smith*) (BMNH) (paralectotype of *Xiphidium propinquum* Redtenbacher).

DISTRIBUTION (Table 1). This species was introduced from America to the Hawaiian Is., originally in the Honolulu area, c. 1890. It was first recorded from the Hawaiian Is. by Bruner in 1895 (Swezey, 1905:212), whence it has spread gradually, now occurring also in the Line Is., Samoa and Cook Is.

***Conocephalus longipennis* (de Haan)**
(Fig. 19)

Locusta (Xiphidium) longipennis de Haan, 1842:189. LECTOTYPE ♂, SUMATRA (RNH, Leiden), here designated [examined].

Xiphidium spinipes Stål, 1877:47. Lectotype ♀, PHILIPPINES (NR, Stockholm), designated by Sjöstedt (1933:29) [examined]. [Synonymized by Hebard, 1922a:245.]

Xiphidium longicorne Redtenbacher, 1891:513. LECTOTYPE ♂, CAROLINE IS. (NM, Vienna), here designated [examined]. [Synonymized by Hebard, 1922a:245.]

Conocephalus carolinensis Willemse, 1942:98. Holotype ♀, CAROLINE IS. (BPBM, Honolulu) [examined].

Syn. n.

Conocephalus carolinensis f. *macroptera* Willemse, 1942:99. Holotype ♀, CAROLINE IS. (BPBM, Honolulu) [examined]. **Syn. n.**

DIAGNOSIS. ♂ ♀. Fastigium of vertex narrow. Prosternum bispinose. Macropterous (occasionally brachypterous outside Pacific). Forewings unicolorous. Cross-veins of costal and precostal areas of forewings regular, parallel, varying to fairly irregular in some females. Stridulatory file of left male forewing shaped as in Fig. 47. Hind femora with 3–7 externoventral spines. Hind tibiae with 6 apical spurs. Male tenth abdominal tergite nearly unmodified, with apical projections very slight and broadly rounded. Male cerci shaped as in Fig. 19, with one internal spine with a globular apex. Female subgenital plate with excised apex. Ovipositor long, relatively straight.

MEASUREMENTS

	Males	Females
Fastigium width	(6): 0.30–0.37 (0.32)	(4): 0.34–0.42 (0.38)
Median length of pronotum	(6): 2.8–3.3 (3.03)	(4): 3.2–3.6 (3.31)
Forewing length	(6): 9.6–18.2 (12.89)	(4): 13.3–17.6 (14.58)
Hind femur length	(5): 12.1–14.2 (12.91)	(3): 13.5–14.5 (14.03)
Ovipositor length		(4): 12.6–15.9 (14.10)

DISCUSSION. *C. longipennis* differs from all the other species included in the present study in the shape of the male cercus and the globular apex of its internal spine. The females can be distinguished from the other species with unicolorous forewings and hind femora with spines, by a combination of the following characters: the long, relatively straight ovipositor, the narrow fastigium, and the excised apex of the female subgenital plate.

All the Pacific specimens examined were macropterous, although some were only just so. They showed a considerable variation in wing length and *C. carolinensis* was originally described as two forms on the basis of this. Comparison of the type-series of *C. carolinensis* and *C. carolinensis* f. *macroptera* with the lectotype and other material of *C. longipennis* has shown them to be conspecific; *C. carolinensis* f. *macroptera* is merely a longer-winged variant. Willemse (1942) gives a photograph of what he refers to as the female 'type' of *C. carolinensis*. When I examined this specimen, which can be easily recognized from the photograph, I found it to be labelled as 'Allotype', while a male specimen in the type-series was labelled as 'Type'. I am nevertheless taking the photographed female specimen as being the holotype by Willemse's published designation.

One specimen of *C. longipennis* was found to have an internoventral spine on one hind femur, and one specimen lacked the internodorsal apical spur on one hind tibia.

I have selected a male lectotype of *Locusta (Xiphidium) longipennis* from 1 ♂, 1 ♀ syntypes I have examined. This lectotype has a forewing length of 20 mm, which is longer than in the Pacific specimens I have seen. One or more syntypes from Borneo: Bandjarmasin are missing.

I have also selected a male lectotype from the 3 ♂, 1 ♀ syntypes of *Xiphidium longicorne* I have examined. Other syntypes which I have not seen have the following data: Caroline Is.: —; Yap (lost, see Weidner, 1966:243); Yap (*Brunner*); Cook Is.: Rarotonga; East Indies.

The lectotype of *Xiphidium spinipes* exceeds the measurements of the Pacific specimens in the following: fastigium width 0.53 mm; median length of pronotum 3.8 mm; forewing length at least 21.8 mm (slightly damaged); hind femur length 17.6 mm and 17.9 mm; ovipositor length 16.8 mm.

MATERIAL EXAMINED

Locusta (Xiphidium) longipennis de Haan, lectotype ♂, **Sumatra**: Padang (RNH, Leiden). *Xiphidium spinipes* Stål, lectotype ♀, **Philippines** (*Semper*) (NR, Stockholm). *Xiphidium longicorne* Redtenbacher, lectotype ♂,

Caroline Is.: Palau Is. (*Semper*) (NM, Vienna). *Conocephalus carolinensis* Willemse, holotype ♀, **Caroline Is.:** Palau Is. Meloikeok, 6.iv.1936 (*Ono*) (BPBM, Honolulu) (mislabelled 'Allotype'). *Conocephalus carolinensis* f. *macroptera* Willemse, holotype ♀, **Caroline Is.:** Ponape, Wone, 11.ii.1936 (*Kondo*) (BPBM, Honolulu).

Caroline Is.: 1 ♀, Ponape, 6.iii.1936 (*Ono*) (NM, Maastricht) (paratype of *Conocephalus carolinensis* f. *macroptera* Willemse); 1 ♂, P., Roi, 14.ii.1936 (*Ono*) (BPBM, Honolulu) (allotype of *Conocephalus carolinensis* f. *macroptera* Willemse); 1 ♀, P., Ronkiti, 4.ii.1936 (*Ono*) (NM, Maastricht) (paratype of *Conocephalus carolinensis* Willemse); 1 ♂, Truk Is., Dublon, 25.xii.1935 (*Ono*) (NM, Maastricht) (paratype of *Conocephalus carolinensis* Willemse); 1 ♂, T., Moen, 27.xii.1935 (*Ono*) (NM, Maastricht) (paratype of *Conocephalus carolinensis* Willemse); 1 ♂, T., Tarik, 3.i.1936 (*Ono*) (BPBM, Honolulu) (paratype, mislabelled 'Type', of *Conocephalus carolinensis* Willemse). **Samoa:** 1 ♂, American, Tutuila, Fagatoga, i (BPBM, Honolulu).

Extralimital material. Oriental Region; **Borneo:** 1 ♂, 1 ♀ (*Boucard*) (NM, Vienna) (paralectotypes of *Xiphidium longicorne* Redtenbacher); **Java:** 1 ♂ (*Candèza*) (NM, Vienna) (paralectotype of *Xiphidium longicorne* Redtenbacher); **Philippines:** 1 ♀ (*Semper*) (NR, Stockholm) (paralectotype of *Xiphidium spinipes* Stål); **Sulawesi:** 1 ♀, Padang (RNH, Leiden) (paralectotype of *Locusta (Xiphidium) longipennis* de Haan); **West Malaysia.**

DISTRIBUTION (Table 1). This species is very restricted in the Pacific, specimens having been seen by me only from the Caroline Is. and Samoa. The species is, however, widespread in the Oriental and Austro-Oriental Regions.

Conocephalus willemsei nom. n.

(Figs 20, 26, 47)

Conocephalus ensiferus Willemse, 1942:97. Holotype ♀, AUSTRALIA (NM, Basle) [examined]. [Homonym of *Conocephalus ensiferus* Bolivar, 1884:88.]

DIAGNOSIS. ♂ ♀. Fastigium of vertex very narrow. Prosternum bispinose. Macropterous. Forewings unicolorous. Cross-veins of costal and precostal areas of forewings regular and parallel to rather irregular in some females. Stridulatory file of left male forewing shaped as in Fig. 47. Hind femora with 1–6 extenroventral spines. Hind tibiae with 6 well-developed apical spurs. Male tenth abdominal tergite with two comparatively large median projections at apex. Male subgenital plate sometimes with small median notch at apex. Male cerci shaped as in Fig. 20, with one internal spine with pointed apex. Ovipositor moderately short to long, broad, shaped as in Fig. 26.

MEASUREMENTS

	Males	Females
Fastigium width	(5): 0.21– 0.36 (0.29)	(4): 0.24– 0.38 (0.32)
Median length of pronotum	(5): 3.0 – 3.3 (3.09)	(5): 3.2 – 4.1 (3.62)
Forewing length	(5): 20.8 –25.0 (21.95)	(5): 24.2 –30.0 (26.39)
Hind femur length	(5): 14.0 –16.4 (15.03)	(4): 14.8 –18.0 (16.51)
Ovipositor length		(5): 9.3 –15.1 (12.01)

DISCUSSION. *C. willemsei* differs from all the other species with unicolorous forewings in the present study in the shape of the male cerci, and the ovipositor. It is similar in some respects to *C. longipennis*, from which it differs additionally in forewing length, and it is the longest-winged *Conocephalus* species in the Pacific. The few specimens I have been able to examine show considerable variation in ovipositor length, both extremes being in Australia. The shape of the male cerci also varies from slender to stout. This species was originally described from a single female as *Conocephalus ensiferus* by Willemse in 1942. I have found this to be a primary homonym of a species described by Bolivar in 1884, from Peru.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Northern Territory, Brock's Creek, 22.iv.1932 (NM, Basle).

Australia: 1 ♂, 2 ♀, Northern Territory, 22 km WSW. of Borrooloola, 16° 08' S, 136° 06' E, iv; 1 ♂, N. T., 5 km NNW. of Cahills Crossing, East Alligator R., 12° 23' S, 132° 57' E, vi; 1 ♂, N. T., Humpty Doo, iii. **New Guinea:** 1 ♂, 2 ♀, Papua New Guinea, Western District, 1–3 km E. of Morehead, 8° 43' S, 141° 39' E, v; 1 ♂, P. N. G., W. D., 2–3 km S. of Morehead, 8° 44' S, 141° 38' E, iv. (BMNH; ANIC, Canberra).

DISTRIBUTION (Table 1). This species was previously known only from N. Australia, but has now also been found to occur in Papua New Guinea, in the south-western area near to Australia.

***Conocephalus bispinatus* sp. n.**

(Figs 21, 25, 56–59)

DESCRIPTION AND DIAGNOSIS. ♂ ♀. Fastigium of vertex very narrow, slightly less than half width of basal antennal segment. Prosternum unarmed. Macropterous. Forewings faintly smoked towards apex and around stridulatory area; otherwise unicolorous. Cross-veins of costal and precostal areas of forewings irregular, or sometimes moderately regular and parallel. Stridulatory file of left male forewing shaped as in Fig. 47. Tympanal region of fore tibiae tending to be bulbous. Mid femora usually with 1–4 externoventral spines. Hind femora with 3–8 externoventral spines, and 0–5 internoventral spines (0 in most Borneo specimens). Hind tibiae with 5–6 apical spurs (internodorsal spur missing, or present but very small). Male tenth abdominal tergite with 2 slight, broadly rounded, apical projections. Male subgenital plate with V-shaped incision. Female subgenital plate with approximately truncate apex. Male cerci as in Fig. 21, with 2 internal spines. Titillators as in Figs 56–59. Ovipositor very short, relatively straight (Fig. 25).

General coloration green, brown, or occasionally straw-coloured. Dorsum of head and pronotum of nearly all females examined with wide, dark stripe, with narrow, light, lateral borders; also with thin dark line at outer edge of light borders, on vertex. This pattern very faint or occasionally absent in males. Frons with large, black-patterned area in nearly all females, absent in males. Hind femora usually with dark brown or red 'herring-bone' pattern externally. Fore and mid femora usually with spots.

MEASUREMENTS**Type-series from New Guinea**

	Male	Females
Total length	27.6	(5): 32.2 – 35.7 (33.54)
Fastigium width	0.26	(6): 0.31 – 0.36 (0.34)
Median length of pronotum	3.1	(6): 3.5 – 4.3 (3.68)
Forewing length	19.5	(6): 22.7 – 28.2 (24.60)
Hind femur length	12.1	(6): 14.2 – 17.7 (15.47)
Ovipositor length		(6): 6.7 – 8.5 (7.35)

Extralimital material (excluded from type-series)

	Males	Females
Total length	(5): 32.6 – 37.0 (33.78)	(4): 35.8 – 37.5 (36.78)
Fastigium width	(5): 0.28 – 0.32 (0.31)	(4): 0.37 – 0.40 (0.38)
Median length of pronotum	(5): 3.2 – 3.6 (3.42)	(4): 3.6 – 4.0 (3.75)
Forewing length	(5): 22.8 – 25.2 (23.66)	(4): 25.2 – 26.7 (25.88)
Hind femur length	(4): 13.4 – 14.9 (13.91)	(4): 15.2 – 16.0 (15.50)
Ovipositor length		(4): 6.8 – 7.9 (7.30)

DISCUSSION. *C. bispinatus* appears to be unique in the genus in almost always having ventral spines on the mid femora. It is one of the few species of the genus with an unarmed prosternum, and differs from all the other species of the genus with this feature by the following characters: bispinose male cerci, 5–6 hind tibial apical spurs, and at least in Pacific specimens of *C. bispinatus*, internoventral hind femoral spines. This last character is rarely found in *Conocephalus*.

The titillators of *C. bispinatus* were examined in the holotype, the single male available from New Guinea, and were found to be slender structures with a spinose apex, of a general form commonly found in *Conocephalus*. The titillators of specimens from Malaya and Thailand were larger and distinctly different in shape from those of the holotype, and those from Borneo were even larger and again strikingly different.

Other differences were evident between the specimens from New Guinea; Malaya, Thailand and Vietnam; and Borneo. Most specimens from Borneo lacked internoventral hind femoral spines while these were present in all the other specimens examined. The apex of the male cerci curved downwards in New Guinea specimens, slightly less so in Borneo specimens, and curved outwards slightly, not downwards, in specimens from Malaya and Thailand. The venation of the costal and precostal areas of the forewing was irregular in New Guinea specimens, although fairly regular in males and variable in females from outside the Pacific area. The tympanal region of the fore tibiae, already bulbous in females from New Guinea, was even more bulbous in both sexes outside the Pacific, particularly in specimens from Thailand and Vietnam. One specimen, from Thailand, lacked spines on one mid femur.

The specimens examined from outside the Pacific region have been excluded from the type-series

because of these differences, particularly in the titillators. The specimens from New Guinea and the two groups of specimens from outside the Pacific may be geographical variants, or they may represent three distinct species, although closely related in many morphological characters. The information available, based on small samples of specimens and without song data, is insufficient to confirm the status of the specimens from outside the Pacific.

MATERIAL EXAMINED

Holotype ♂, **New Guinea**: Papua New Guinea, Western District, Morehead, 8° 43' S, 141° 38' E, 29.iv.1971 (*Balderson*) (ANIC, Canberra).

Paratypes. **New Guinea**: 1 ♀, Papua New Guinea, Morobe District, Wau, 1200 m, 15.v.1962 (*Sedlacek*) (BMNH); 1 ♀, P. N. G., Morobe District, Wau, 1700–1800 m, 17.xi.1961 (*Sedlacek*) (BPBM, Honolulu); 2 ♀, P. N. G., Port Moresby, Mt Lawes, 400 m, 5.iii–12.v.1963 (*Brandt*) (ANIC, Canberra); 1 ♀, P. N. G., Port Moresby, Mt Lawes, 400 m, iv.1963 (*Brandt*) (BMNH); 1 ♀, P. N. G. Western District, Morehead, 8° 43' S, 141° 38' E, 28.iv.1971 (*Balderson & Baker*) (ANIC, Canberra).

Material excluded from the type-series. **Borneo**: 2 ♂, Sabah, 11 km SSE. of Telupid, R. Karamuak, 60 m, 1–7.ix.1977 (*Bacchus*) (BMNH); 1 ♀, Sabah, 13 km S. of Telupid, Tawai Plateau, 400 m, 8.ix.1977 (*Bacchus*) (BMNH); 1 ♀, Sarawak, Gunong Mulu National Park, ii–vii.1978 (*Collins* (R.G.S. Exped. 1977–8)) (BMNH); 1 ♀, Sarawak, Gunong Mulu National Park, Long Pala (base), 70 m, alluvial, secondary forest, MV light trap, on batu, canopy, iii.1978 (*Holloway et al.* (R.G.S. Exped. 1977–8)) (BMNH); 1 ♂, Sarawak, Gunong Mulu National Park, 150 m, helipad, mixed dipterocarp forest, mainly canopy, MV light trap, ii.1978 (*Holloway et al.* (R.G.S. Exped. 1977–8)) (BMNH). **Thailand**: 1 ♂, in black light trap, vi.1963 (BMNH). **Vietnam**: 1 ♀, Di Linh, 27.ix–14.x.1960 (*Yoshimoto*) (BPBM, Honolulu). **West Malaysia**: 1 ♂, Kuala Lumpur, 24–31.xii.1958 (*Quata*) (BPBM, Honolulu).

DISTRIBUTION. This species, known in the Pacific only from Papua New Guinea, extends westwards to Thailand.

Conocephalus tridens Hebard

(Figs 22, 27)

Conocephalus tridens Hebard, 1933: 127. Holotype ♂, MARQUESAS IS. (BPBM, Honolulu) [examined].

DIAGNOSIS. ♂ ♀. Fastigium of vertex narrow. Prosternum unarmed. Macropterous. Forewings often with narrow band of rather faint pigmentation just below *R*, together with spots above this vein; sometimes unicolorous. Cross-veins of costal and precostal areas of forewings regular, parallel. Stridulatory file of left male forewing intermediate in shape between those shown in Figs 45, 46, and 47. Hind femora unarmed ventrally. Hind tibiae with 6 apical spurs. Male tenth abdominal tergite widely truncate at apex. Male cerci as in Fig. 22, with 3 internal spines. Ovipositor short and curved as in Fig. 27.

MEASUREMENTS

	Males	Females
Fastigium width	(7): 0.21–0.37 (0.28)	(7): 0.21–0.40 (0.32)
Median length of pronotum	(8): 3.4 – 4.1 (3.76)	(7): 3.6 – 4.2 (3.91)
Forewing length	(8): 14.4 – 18.7 (16.54)	(7): 15.1 – 21.0 (17.66)
Hind femur length	(8): 11.5 – 14.3 (12.55)	(7): 12.2 – 14.6 (13.06)
Ovipositor length		(6): 7.3 – 8.4 (7.77)

DISCUSSION. This species has several distinctive characters which separate it from all the other Pacific species of *Conocephalus*, including the form of the male cerci and the strongly curved ovipositor. Only one of these species, *C. bispinatus*, shares with *C. tridens* the unarmed prosternum.

MATERIAL EXAMINED

Holotype ♂, **Marquesas Is.**: Eiao, Vaituha, 370 m, on *Cassia occidentalis*, 3.x.1929 (*Adamson*) (BPBM, Honolulu).

Marquesas Is.: 2 ♂, Eiao, above Vaituha, 240 m, 29.ix.1929 (*Adamson*) (ANS, Philadelphia) (paratypes); 1 ♂, 1 ♀, E., above Vaituha, 340 m, on *Dodonaea viscosa*, 2.x.1929 (*Adamson*) (ANS, Philadelphia) (paratypes); 1 ♀, E., 520 m, 16.iv.1931 (*Le Bronnec & Tauraa*) (ANS, Philadelphia) (paratype); 1 ♀, E., 520 m, iv (ANS, Philadelphia); 1 ♂, E., c. 550 m, on *Sida* sp., 22.iv.1931 (*Le Bronnec & Tauraa*) (ANS, Philadelphia) (paratype); 1 ♂ nymph, E., 550 m, iv (ANS, Philadelphia); 1 ♀, E., near centre, 400 m, 1.x.1929 (*Adamson*) (ANS, Philadelphia) (paratype); 1 ♂, Fatu Hiva, i (BMNH); 1 ♂, Hiva Oa, i (BMNH); 1 ♀, H., Kaava Ridge,

Kakahopuanui, 610 m, x (ANS, Philadelphia); 1 ♂, Tahuata, Amatea, 790 m, 27.vi.1930 (*Le Bronnec & Tauraa*) (ANS, Philadelphia) (paratype); 1 ♀, T., Amatea, 820 m, 7.vii.1930 (*Le Bronnec & Tauraa*) (ANS, Philadelphia) (paratype); 1 ♀ nymph, T., Vaitupaahei, 700 m, vii (ANS, Philadelphia).

DISTRIBUTION (Table 1). This species is endemic in the Marquesas Is.

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